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SPORTS CARS ILLUSTRATED

FEBRUARY 1957 35c

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TECH REPORT-THE FASTEST PORSCHE page 32

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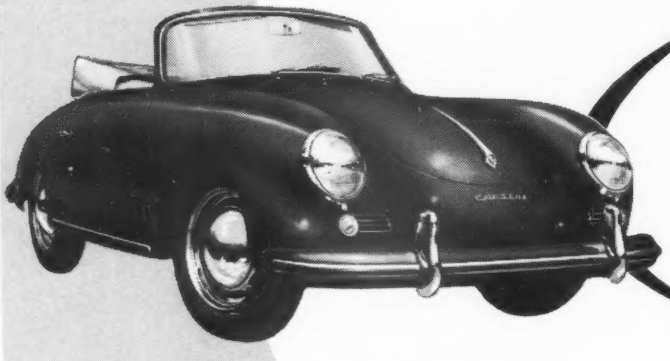

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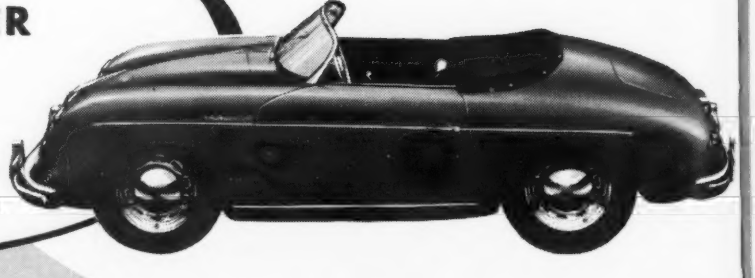

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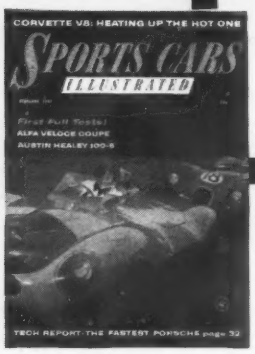

Carlyle Blackwell shot this Ektachrome of a pair of competition Jaguars booming through the night. Whether you build your own or buy it, the Jag Six is just aching for things that add so much. See page 44.

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EDITORIAL AND EXECUTIVE OFFICES
366 Madison Ave.
New York 17, N. Y.

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A ZIFF DAVIS PUBLICATION

BRANCH OFFICES: Chicago Office, 64 E. Lake St., Chicago 1, Ill.; Los Angeles Office, 215 West 7th Street, Los Angeles 14, Calif.

SPORTS CARS ILLUSTRATED is published monthly by the Ziff-Davis Publishing Company, William B. Ziff, Chairman of the Board (1946-1953), at 64 E. Lake St., Chicago 1, Ill. Entered as second class matter at Post Office, Chicago, Illinois, under the Act of March 3, 1879.
SUBSCRIPTION RATES: One year, U.S. and Possessions and Canada $4.00; Pan American Union Countries $4.50; all other foreign countries $5.00.
SUBSCRIPTION SERVICE: All correspondence concerning subscriptions should be addressed to Circulation Dept., 64 E. Lake St., Chicago 1, Ill. Please allow at least four weeks for change of address. Include your old address as well as new — enclosing if possible an address label from a recent issue of this magazine.
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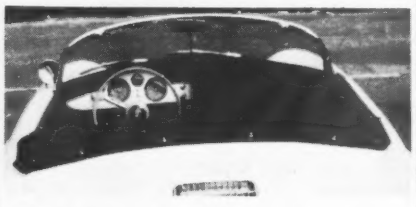
MARION'S MEANDERINGS

By Marion Weber

Hi, there! It certainly is a pleasure to be home again even though our trip to Europe was simply fabulous. We saw and enjoyed the things we had dreamed about for years and met the greatest people. We also made arrangements to import some of the Continent's most interesting auto accessories and clothing items. More about that next month when the things we ordered will be in stock. Right now we must discuss gizmos which have been MG Mitten standbys for years and so popular . . . mostly because they are great values, I think. Tonneau covers, for instance. Not all cars come so equipped, but you know how much you'd use one if you had it. Ours are really tailored to fit. They save your car's interior and provide all weather protection while letting you enjoy having the top down. Center zippered, of course.



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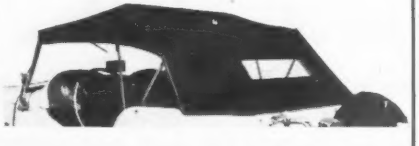

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very sincerely yours:

FOR every safety measure proposed by one of the governing bodies of sports car racing there is always a vociferous band of free-lance critics. Such was the case with safety belts. Such also was the case with roll bars.

When safety belts were made mandatory some years back the vociferous ones shouted loudly that "the Europeans don't use 'em." They cited the avoidances of famous G. P. drivers who were thrown clear of wrecks. What they failed to take into account was that the average Grand Prix car is so lightly built that it'll fold like a Japanese parasol in a smash that would just bang up fenders on the average Jaguar or Porsche.

Roll bars were a slightly different story. The criticisms here were that roll bars would louse up the styling and – horrors – look *ugly*. They forgot that a blood-smeared cowling is an even more unpleasant sight. After the amazing series of flips by the entire Cunningham team at Elkhart lake last spring the criticisms died a-gurgling. Every Jaguar driver walked away scatheless due to the sturdy roll bars Cunningham's crew had concealed under the D-types' head rests.

Now we have another item for the feet-draggers to tune up on – safety plates. These are circular plates of ⅜-inch steel cut to fit the center section of a disc wheel and with a hole in the middle to admit the protruding hub. The plate is drilled and countersunk to fit the lug pattern and then balanced. This item fits over the mounted wheel and then the lug nuts are put on and tightened with the result that there is no remote possibility of the wheel breaking or of the lugs pulling through under racing stresses.

These plates were first used when track roadsters using disc wheels began tossing rolling gear into spectator stands with resultant maiming and at least one death. Later, during the days when Singers were giving MG-TD's a rough time they were adopted voluntarily by the Singer contingent whose mounts had a habit of shedding disc wheels at embarrassing moments.

The practice died out with the disappearance of the Singer from competition status. But last fall at a race on the new course at Pomona, California, a policeman was critically injured by a tossed wheel from a car, the make of which is unimportant. What is important is that it happened at all. Fully cognizant of this the sponsoring club instituted a ruling that certain disc-wheeled cars would henceforth use safety plates or they wouldn't run. The protests haven't died down yet. One always wonders why these protests are made against measures designed to save lives, particularly in this case when it is so obvious that a wild wheel, careering around like a rhinosceros with a skinful of hashish, can crush a person like a paper box. Yet the main protester in this last instance was the distributor of the car that shed the wheel. The big wonder of it is that he didn't insist, with the club, that *all* disc-wheeled cars run safety plates.

Come to think of it, does anyone want to argue about safety *hubs* too? Or safety?

* * *

Back to more pleasant subjects – like this issue f'rinstance. Leading off the book is something new in motor show coverage. We asked our displaced Yank, Merwin Dembling, to look in on Earl's Court to see what the English have on tap. Together with some interesting new machinery, he found some disgruntled British reporters who insisted there was nothing to see. Our man disagreed and so do we; there's a lot to like in the '57 imports. To see what there is and the cause for the disgruntlement turn to page 12.

* * *

For those who like to make things go, we have two offerings this month – a round-up on what people are doing with and to the fabulous Chev Corvette and the latest in speed equipment for the competition Jaguar. Also, to see what makes for speed check the centerfold feature beginning on page 32. Griff Borgeson and C. O. LaTourette have outdone themselves this time with the Porsche Spyder.

—john christy

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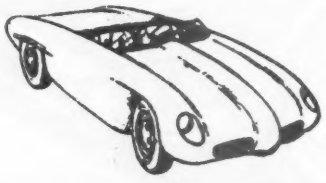

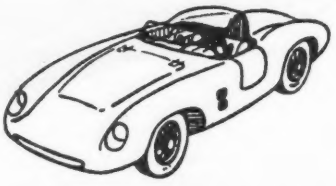

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letters

confused

Gentlemen:

About your November article on Chuck Porter's 300 SLS—I was under the impression that the 300 SLR was the car that was rebuilt from a wrecked and burned 300 SL, but according to your article, the 300 SLR was a car built by Mercedes. Could you please straighten out this point for me?

Sincerely,
PFC Donald R. Stewart
APO 108, New York

There are three cars involved here. One is the 300 SLR; a factory-built, factory-campaigned team car. Probably no more than 10 of these were built in all and none were sold. One of them was given to the Ford Museum in Dearborn. The rest are in honorable retirement. The second car involved is Chuck Porter's rebuilt standard SL which he arbitrarily named "SLS." Shortly thereafter, Mercedes came out with its SLS, which, though it is similar to Porter's in that both are open and hotter versions of the 300 SL, is a different car. Confusion was bound to occur on this point. —Ed.

thumbs down

Dear Sir:

I have subscribed to SCI for one year and with each issue I become more disgusted. Before your "big change" in the early part of 1956, the magazine was at least interesting, if not very informative. I am not alone in my criticisms, either. Everyone I have talked with agrees with me that the only articles in your magazine that are worth reading have appeared in substance in another magazine some two months before.

I am interested in thoroughbred sports cars, not fast hot rods. Please don't send me any more of your advertising literature as my waste basket is getting full.

Sincerely,
Peter Lewis
Orinda, California

mg car club

Dear Sirs:

My congratulations on your fine magazine. I think it is the best magazine of its kind on the stands.

I have only recently bought my first sports car, a 1956 MG-A. I would like very much to become a member of the MG Car Club—can you send me the address?

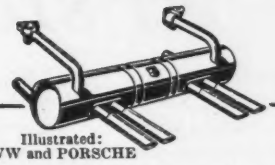
Thank you,
Jim Elrod
Macon, Georgia

To contact the MG club in your area, write to Dr. Kenneth F. Thompson, 3801 Hayfield Place, Alexandria, Virginia.—Ed.

"A Must!" — SPORTS CARS ILLUSTRATED

FOR TERRIFIC GET-AWAY! FOR ECONOMY!

ABARTH



Illustrated: VW and PORSCHE

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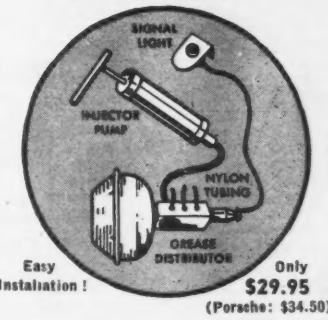

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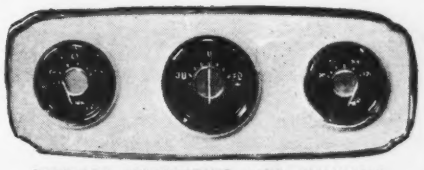

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PIT STOP

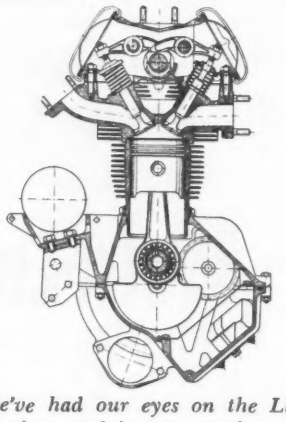
By KARL LUDVIGSEN

DEVELOPMENT POTENTIAL

In the November, 1955 issue of SCI, the German Lloyd car is pictured on page 14 and mentioned on page 58. Please let me know where I can get more information on the Lloyd, as it seems to be just the type of machine that I'd like to own.

Bernard W. Bates
North Harwich, Mass.

The address of the Lloyd factory is as follows: Lloyd Motoren Werke GmbH, Bremen-Neustadt, Germany.



We've had our eyes on the Lloyd for some time, and it seems to have potentialities both for everyday use and for hopping-up sports car purposes. Its bore and stroke are 77 x 64 mm, and displacement is 596 cc. The two parallel cylinders are air-cooled, and are fed by inclined overhead valves in a semi-hemispherical chamber. The single overhead cam actuates adjustable rockers and drives the distributor directly. A simple built-up crankshaft allows ball and roller bearings to be used throughout the bottom end.

Right now it's putting out 24 US bhp at 4500 rpm, on a compression ratio of 6.6/1. By increasing valve sizes and port diameters, and installing additional valve springs, a hotter cam and higher-compression pistons, it could be made to howl in no mean fashion. It's mounted transversely in the car, in unit with (unfortunately) a three-speed gearbox. Also in the package is the final drive and differential, for the front wheel drive, and it acts as a mounting for certain parts of the front suspension. All in all a very tempting unit.

THE LAST ENGINE SWAP

I have long been interested in specials, and think that Mr. Porter's bomb in your wonderful November issue really tops them all. I have been thinking of dropping a Chevvy V-8 in a 1949 MG TC. I've seen Ford sixtys work fine, and I wondered if this swap would be very expensive if done by a good swap man.

A/2c Dennis Pesek
Plattsburg A.F.B., N.Y.

These are the facts: If you used the Chevrolet transmission, it wouldn't be too hard to get the V-8 into a TC. There would be interference with the steering column and the pedals, and a bigger radiator would probably be needed, but these are all common problems to an experienced swap man. It would of course be expensive, but not so bad as if a new bell housing or reworked steering linkage were necessary.

But think it over. The TC is a nicely balanced car as it is, but you know how skitterish it gets up around 75 mph. It would be a beast with all that power and that heavy Chevvy up in the front end. The frame is just too darn flexible, and the machine is too small.

If you mounted the engine on two vertical plates placed across the car and tied firmly into the chassis, you might get enough stiffness, but the vibration at idling might be more than you would like. The engine must also be set well back, to avoid nose-heaviness, and legroom may suffer. You should have an entirely new rear axle, cut-down to the MG tread, both to get the right ratios and the necessary strength. Cutting down the wire wheels to 16 inches would be a must, for decent handling and traction. I've seen an early Morgan Plus Four with a Chev stuffed in it. Most of the above precautions were taken, and as a result it was a roadworthy car. Except for the brakes, where the TC will fall down also. A TD would be a better basis, but that's not saying much. Don't let us discourage you, though, and let us know how it comes out.

BANSHEE IN THE BUSTLE

Can you tell me if there is such a thing as a silent Judson supercharger installation in a Volkswagen? Judson tells me I have an intake leak which unbalances the blower, but for the life of me I can't find the leak. The vanes slap like a bunch of banshees, and it's very embarassing at times. Should the vanes be of a different material, or possibly thicker?

H. A. Diehl
Pittston, Pa.

The Volkswagen Club of America (PO Box 34, Leonia, N.J.) tells us that a slight vane slap is natural. Excessive slap is usually caused by a manifold leak, which may occur at the manifold heater in cars built before late 1955. If vanes are noisy when the unit is excessively warm, it indicates that replacement is necessary. This can happen in less than 10,000 miles, and is quite inexpensive. Make sure the oiler is feeding at least the specified quantity, and preferably slightly more.

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The Horse Strikes Back

Show Review: Earl's Court, 1956.

BY MERWIN DEMBLING

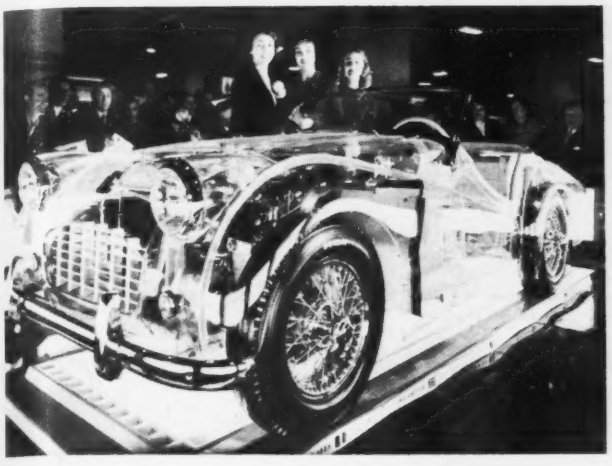
IF pipe dreams could drown you, the words "big European show" would always be followed by a yell of "Run for your lives, men—the dam's busted!" At the mere mention of the wing-dings in London, Paris or Turin, yokels from Portland, Maine to Portland, Oregon (and all the whistle-stops in between, like New York, Chicago and L.A.) grab for the opium feedline, and indulge in some highly technicolored, hokum-filled reveries.

These are generally in line with the addict's interests. Classics fans dream of the return of Hispano-Suiza, sporting types hope breathlessly for the little man in Milan, Molsheim, or Coventry to come out of the woodwork with something really splendiferous: engine by Longines-Wittnauer, body by Marilyn Monroe, exhaust note by Ludwig van Beethoven, and suspension by Paris Garters. And the man in the street has the most fantastic vision of all—of a peppy, solid little car he could buy without rupture of the checkbook. The one thing all these pipe-dreams have in common is the fervent belief that there's something new and wonderful at the Salon de Timbuctoo.

Well, sometimes, there is, and sometimes there ain't. Touted as the most important British show since the war, this year's London International Motor Show made such lukewarm news that it was all but elbowed off the nation's front pages by a sizzling little item to the effect that the Portuguese Society for the Prevention of Cruelty to Animals had finally succeeded in getting fried sparrows banned from Lisbon restaurants.

Photos Courtesy of the author and Eastern Publishers Service

Represented by the automotive manufacturers the world over, the 1956 Earls Court was studded with an array of gleaming varieties ranging from chrome plated miscellaneous hardware to a Flash Gordon interplanetary space sled.



A TR-3 showed off its interior construction as well as its outer form with a Perspex body.

MGA, now obtainable in coupe version, incorporates wrap-around rear windshield and wind-up windows.

This symbol of the future is fast reaching into reality. (See January SCI).

Stafford Hutchinson examines self adjusting disc brakes fitted to a Jensen.

S. Moss proves he can see over top of Buick Centurion's steering wheel.

This public relations misfortune is only one cause for the great gobs of gloom that stand knee-deep around the palatial Piccadilly premises of the Society of Motor Manufacturers and Traders.

The Suez Canal mess has thrown delivery schedules into complete confusion—5,000 cars destined for U.S. West Coast ports are hanging around the docks waiting for ship space. And the chorus of boos and jeers at home has been getting so loud lately that F. A. Perkins, President of the Society, in his speech of welcome at the pre-Show dinner, complained: "The British press has given the impression lately that the motor industry is on the decline."

The English are apt to be hard on their own cars because a murderous sales tax and rough installment buying conditions price a huge hunk of the well-wishing public right out of the market. General frustration at this state of affairs has resulted in a cynical, sour-grapes attitude toward the cars themselves. Every little fault, real or imagined, is magnified to justify the feeling that "I can't get a new car, so just for spite I don't want one anyway." As one of my British colleagues asked me ruefully at the press opening, "What can you possibly tell the Americans about our potato-shaped English motorcars?"

Plenty. Maybe I'm just a vegetarian at heart, but there's a lot to like in this year's crop. Moreover, going to an automobile show doesn't mean you have to eat your heart out because you can't take home every shiny specimen on the stands.

For instance, it gives one a nice feeling of superiority to be able to say, "well—finally!" at the news that Rolls Royce is now available with power steering, automatic transmission, and on models for export to hot countries, air conditioning. It is amusing to note the hoopla and whoop-de-doo over the fact that a Park Ward bodied Silver Wraith has a small wire recorder built in so that busy tycoons can dictate as they travel. On a car costing in excess of $23,000 one is justified in expecting at least a built-in blonde secretary, among whose talents shorthand would be the least.

(Continued on page 50)

FEBRUARY '57

SPORTS CARS ILLUSTRATED

SCI

ROAD TEST: the amazing Alfa Veloce Coupe

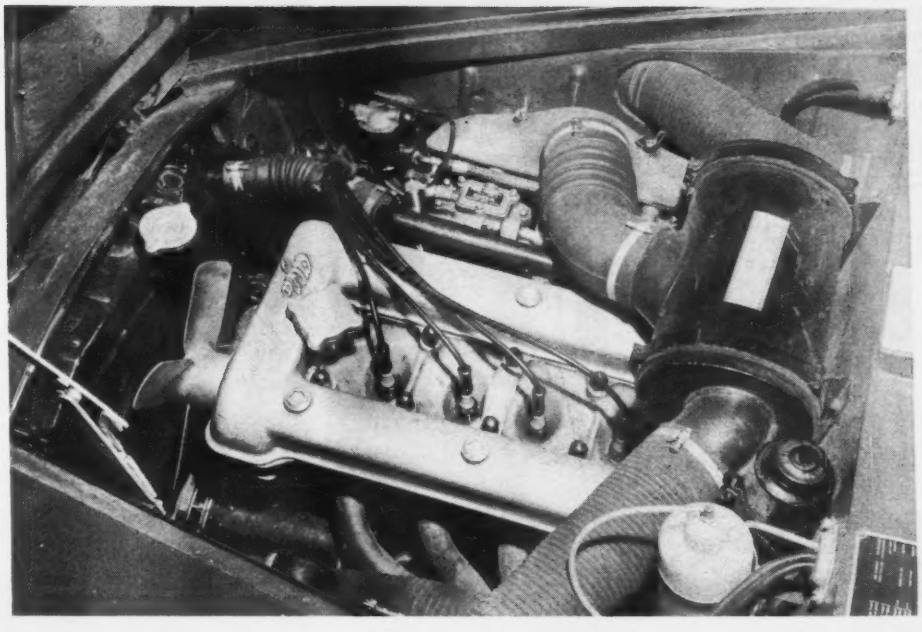
Resemblance of the Sprint Veloce to the Alfa Romeo Giulietta is limited to exterior appearance. Terrific weight savings have been achieved through extensive use of aluminum in hood, trunk and door panels, and bumpers

ITALIAN manufacturers know that as soon as they build a car that it's going to be raced in the Mille Miglia; because of this, they are forced to build an automobile that will handle reasonably well, and to design an engine that won't fly apart when an imitator of Tazio Nuvolari goofs and misses a shift.

All this applies in particular to the small Fiats and, more recently, to the positively amazing Giulietta Sprint Veloce, the competition version of the normal 1300 cc Giulietta Sprint. The Sprint is a fine, high speed, touring-sports car, relatively quiet, with roll up windows, and a top speed of just under 100 miles per hour. But the Sprint Veloce is considerably more than this. The car was literally born in the mountains of Italy—on the Radicofani, the Futa and the Raticosa mountain passes which make up the most rugged part of the Mille Miglia.

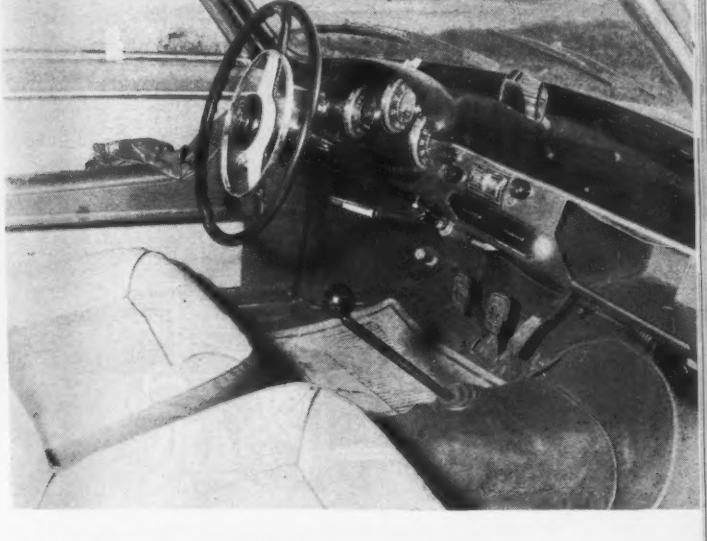
When the normal Giulietta first came out, it had its baptism in the 1955 Mille Miglia, but was badly beaten by several well driven 1300 Porsches. Alfa was already designing a competition version for the next year. Thus was born the Sprint Veloce, a 1300 cc sports car which is a real Italian racing car with dual Weber double choke 40DC03 carburetors, a centrally mounted four speed gearbox, and a hot-rodded 1300 cc mill which conservatively produces 90 bhp at 6000 rpm. The car's maximum speed was increased to an honest 110 mph which resulted in a car that swept the 1300 cc Gran Tourismo class in victory after victory. One indication of the car's capabilities is the fact that it immediately broke all previous 1300 Porsche records on the Nürburgring; the Giulietta Sprint Veloce is, in short, the most sensational competition car to come out of Italy in 1956.

Veloces are scarce and it was only through the generosity of Bob Tappan, owner of this car, that we were able to make the test. It was immediately taken over one of the roughest stretches of mountain road in all of Italy—the bit of highway between Florence and Bologna which twists up and over mountain passes, the Futa and the Raticosa. This is the kind of road which shows up the merits and demerits of any car that is driven hard over it. When you first get into the Veloce, you find the seats are extremely soft, so soft in fact that if you're short, you find yourself looking through



Air intake hides second Weber carburetor. Plugs are accessible for easy changing. Fuel filter and brake master cylinder are handy for servicing.

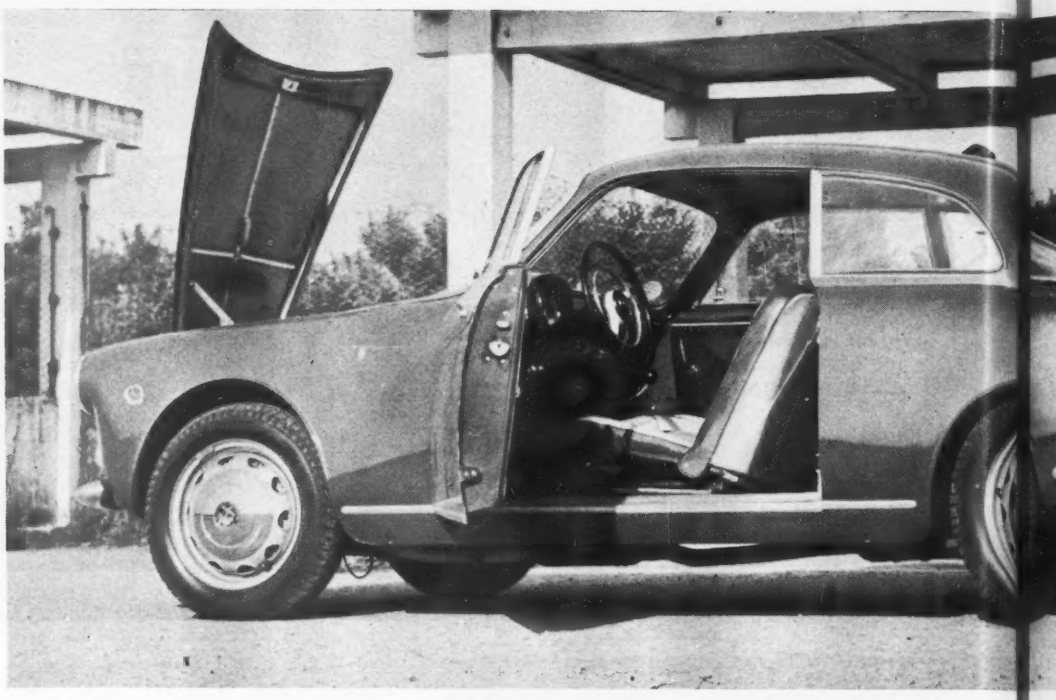
Under hard cornering conditions, normal understeer characteristic can be neutralized by playing with gas pedal and steering wheel. Car is literally steered by provoking rear-end breakaway.



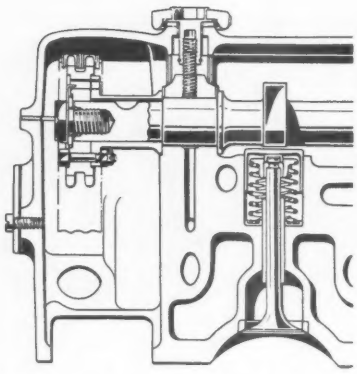
Gear shift lever is centrally located, as in more civilized version. Bucket seats are on the soft side, but give good back and lateral support to driver. Steering is only 2½ turns lock to lock.

the upper half of the steering wheel, but a little padding in the right places takes care of this. Lateral support is good and the rugged, centrally mounted gear shift lever fits into the palm of your hand—exactly the way a competition shift would. In fact, the more you look at this baby Alfa, the more you realize that it was expressly designed for competition. Plastic windows, lightweight aluminum doors, the bucket seats, and under the hood the dual Webers and the extractor-tuned exhaust manifold, are visible signs of the Veloce's role in life. But it's not until you get the car out onto the road that you fully appreciate what Alfa has created. The tach is red-lined at 6700 rpm and with this limit even in normal driving, the needle hardly ever sees six. If you're used to driving a car where you have to keep more than one eye on the rev counter, the Veloce will be a revelation. At 5000-6000, all 1290 cc's sing in harmonious contentment and the driver gets the impression of almost unlimited rpm, let alone unlimited acceleration. Power comes in fully at 4500 rpm on the Veloce and in second gear, the short space of time that it takes to go from 4500 to 6500 rpm is quick enough to pull out of any demanding situation. On the road, the car gives the driver a feeling of complete security. The quick, extremely light steering, the extraordinary braking ability and the car's compact size all make for fantastic maneuverability and allows the driver to put the Veloce through slots where even 300 SL's fear to tread. This is what a real Gran Turismo machine should be able to do and this Alfa never lets the driver down.

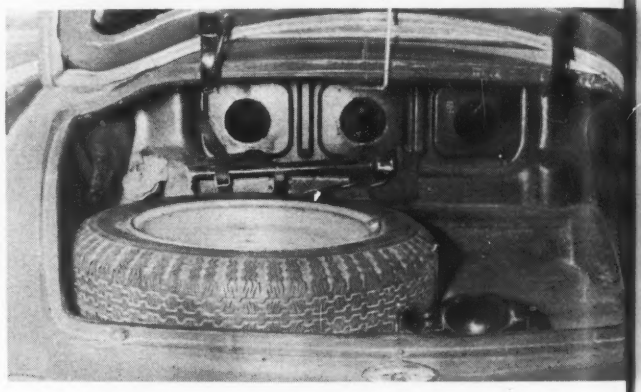
The Veloce has a steering characteristic that is difficult to find among high performance machinery. Under normal driving conditions, the car has a decided understeer. However, under hard cornering conditions, a transition from understeer to neutral steer can easily be effected by playing with the gas pedal and the steering wheel. This, of course, results in an extremely flexible automobile in which the driver is at home in a minute. The steering box is of ZF manufacture which accounts for its lightness. What is interesting is that it takes the same amount of effort to hold the Veloce on full lock as it does when on half lock. Steering return is not vicious and has this constant feel to it which



Entry and exit are considered very good for a sports car. Use of plexiglass windows eliminates window mechanism in doors, results in added elbow room inside car. Although rear quarter windows open, ventilation is not tops. Sprint Veloce body is built by Bertone.



Details of overhead cam system. Chain drive sprocket is at left. Double valve springs are counter-wound. Valve adjustment is through use of shim caps over valve stem, under lifter cup.



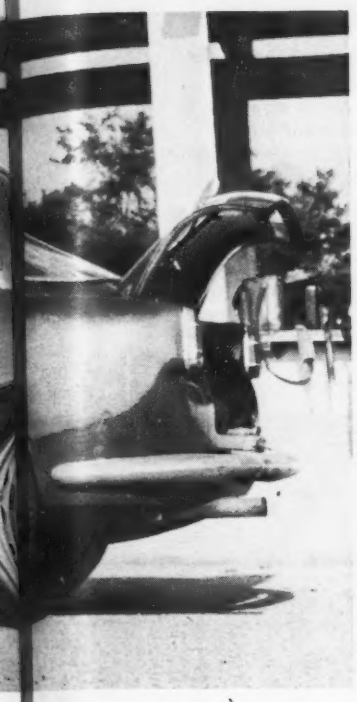
Trunk compartment carries spare, jack and lug wrench, plus filler cap for 21-gallon fuel tank. Luggage space is at a premium compared to barn-like interiors in current Detroit cars.

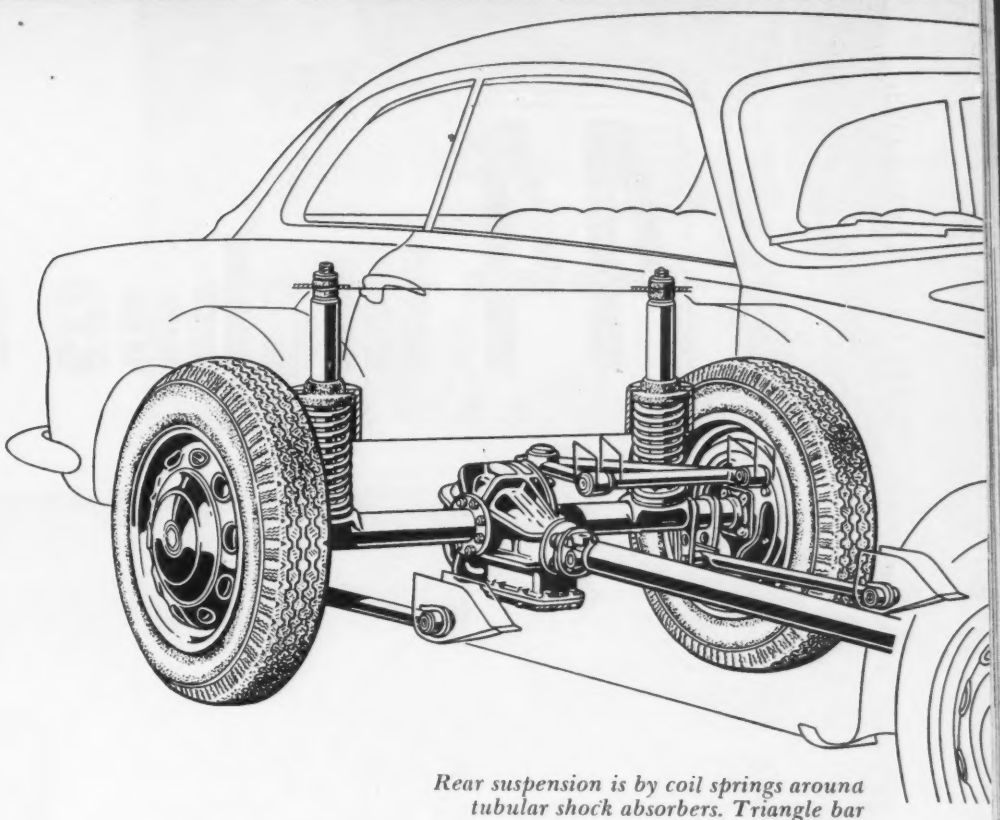
makes for really pleasant driving. Two and a half turns from lock to lock is just about right, and with no play in the wheel nor shock from the road, the Veloce is undoubtedly one of the easiest cars to maneuver that we've ever experienced. But that's getting ahead of the logical procession of things, so let's take a close look at how the car is put together.

Overall quality of workmanship on the Veloce is not as good as on competitive German cars nor is it as good as the production normal Sprints. The plexiglass window slides have a tendency to stick shut and are not the most convenient things to open and shut. One big advantage to the sliding windows is that the area in the doors where the roll ups on the Sprint fit, is completely cut out and allows for an extra amount of elbow and storage room. This, and the huge amount of space behind the seats make up for the small trunk and practically useless glove compartment. The dash is laid out well, but the instruments, especially the tach, are difficult to read. The hand brake is probably the poorest item on the car—being stiff and awkward to release. But defects like this can be excused when one realizes that the hand brake and the glove compartment just aren't meant to be used on the Veloce since the car is a competition machine pure and simple.

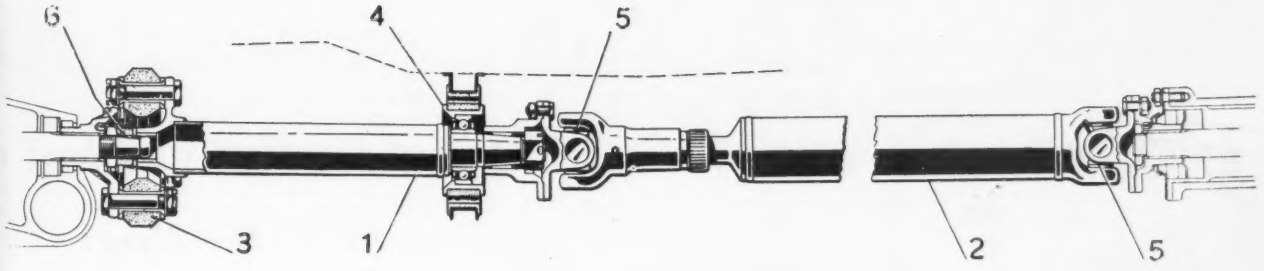
For a sports car, entry and exit is very good. The seats, despite the fact that they're too soft, offer good lateral and vertical support and the offset driving position is hardly noticeable until pointed out by an observant passenger. The car is equipped with a heater and defroster unit that could not be put through a test in the hot Italian summer but would probably prove to be adequate enough for a harsh New England winter. Wind noise is quite noticeable over 90 miles an hour. At that speed, a loud whistle emanates from around the windshield pillars. Ventilation also leaves a bit to be desired on the Veloce coupe despite the presence of fresh air ducts under the dash and plexiglass rear quarter windows that crack open.

Engine accessibility is really terrific. The plugs can be changed in a flash and the dip stick does not hover close to the exhaust manifold as is standard practice on many cars. Fuel filter, master cylinder, and carburetor intake air filter are close at hand as soon as the aluminum, forward hinged, hood is lifted. The trunk contains the gas filler for the 21 gallon tank which is special on all Veloces, as well as the





Rear suspension is by coil springs around tubular shock absorbers. Triangle bar arrangement to the right of the differential acts as a lateral stabilizer.



Two section drive shaft is used in the Sprint Veloce. 1—front section; 2—rear section; 3—rubber bushing point at transmission; 4—intermediate support; 5—universal joints; 6—grease seal at end of transmission main shaft.

battery, spare tire, and tools. The bumpers are of aluminum—another difference between the Veloce and the normal Sprint. Alfa has let no item go unseen to cut the weight factor.

But let's take the Veloce out onto the road and see how she goes. The engine is almost instantaneous in its response to the key starter. A rough idle makes you note that the tach does not read under 2000 rpm—the double overhead cam engine is meant to be kept at 5000. Getting away from rest and jabbing the gas pedal you feel the surge of the throttle response. With the windows open, and when passing through a tunnel or down a street ringed by tall buildings, you can hear the singular exhaust noise that is pecular to the Veloces; it's sort of a high pitched rasp that only the Veloce owns and when you get a bunch of them together on a circuit, you get buzzing not unlike a bunch of angry hornets.

Maximum speeds in gears are as follows: 1st, 37 mph; 2nd, 55; 3rd, 80 plus; 4th, a good 111 mph. In fierce acceleration the tach is taken right up to the red line at 6700, and if really pressed, on up to 7000 rpm. The gear shift is sheer pleasure, being very solid and rugged to the touch and very definite. There is never any question as to which gear is doing the pulling. Rapid down shifts can be made with or without double clutching and first is completely synchronized giving the driver excellent control in hard and fast mountain driving. The clutch seems stiff at first but this is due to the relatively high low gear.

When accelerating, you are overwhelmed by the fact that this is only 1290 tiny cc's, every one of which is really doing more than its maximum bit of work. The acceleration of the car is fantastic. Zero to sixty mph in 10.5 seconds; zero to one hundred in 26.5 seconds. The standing quarter was covered in 18.1 seconds—very fine going for a small displacement machine. Cruising speed is limited only by the driver's adversity to noise since over 90 mph the wind noise begins to become more than noticeable. Tracking on the straight was found to be anything but good above 90. At that speed the car developed a slight wander tendency. Safe all day cruising could be held at 85 with complete security and ease.

In hard cornering, the Veloce, as does the normal Sprint, exhibits marked roll habit, but this roll is noticeable only to outsiders—passenger and driver being completely oblivious to it. The aforementioned characteristic of understeer on the Veloce is good in that while holding the car on neutral steer

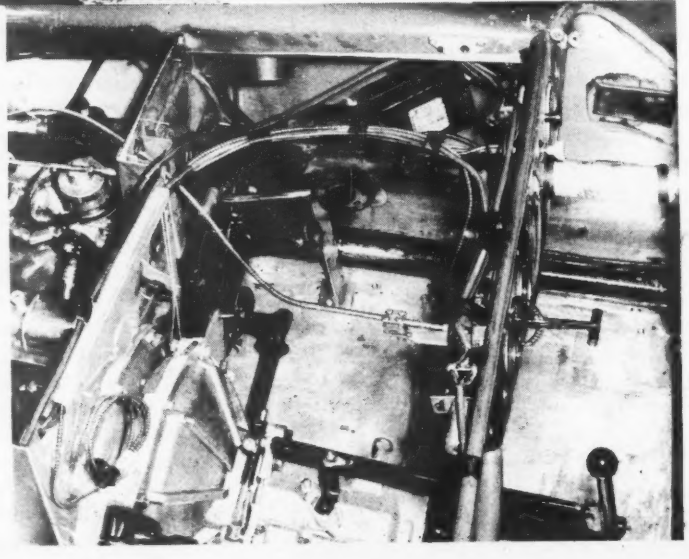
(Continued on page 55)

44 inches of fight

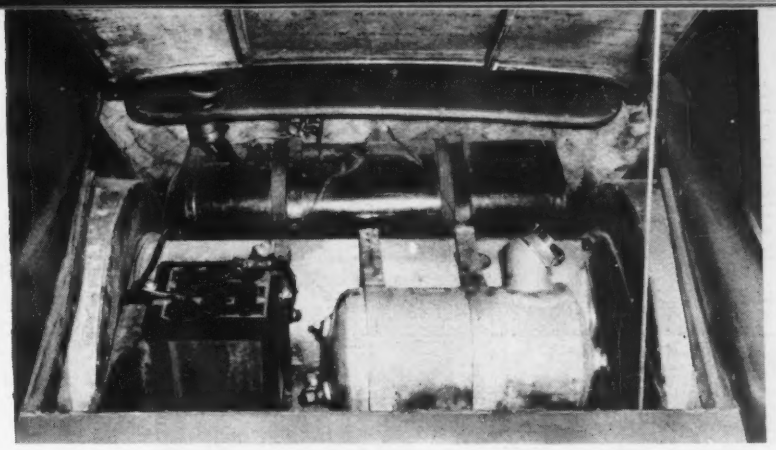
By PETER SUKALAC

The tight, box-shaped little bomb looks and is flat and steady as Harry Eyerly tosses it through a tight turn at Pebble Beach. A stiff basic frame and a highly-developed suspension keep it consistently controllable in all situations. Harry says, "Keep it simple." Much easier to find the bugs and work them out if that's the case.

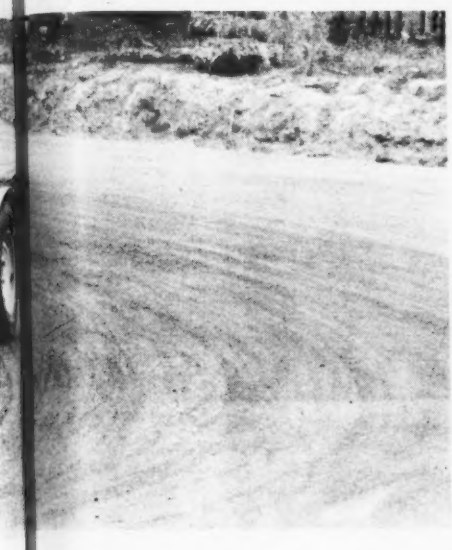
One of the first and best of the sizzling 750's, the Eyerly Crosley has been winning for three years.

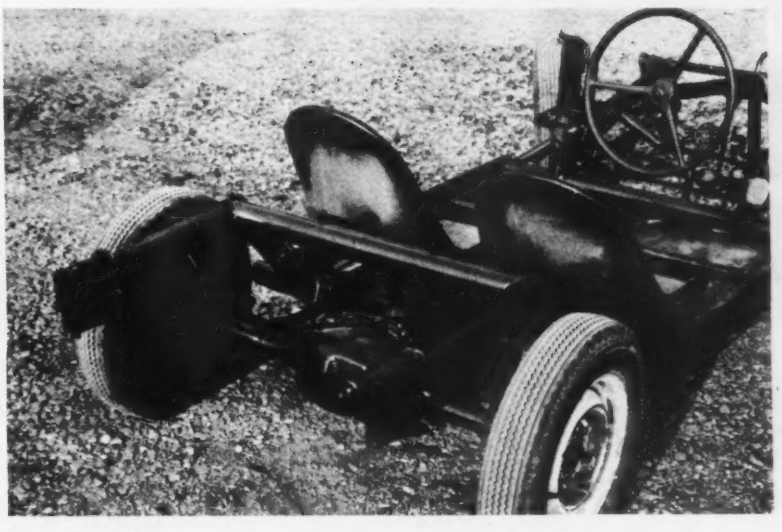


ABOVE: Bodywork on Eyerly machine is simple, to the point. Compound curves were avoided by clever bending around nose. Hood scoop is for old carb. RIGHT: Direct-acting clutch pedal has replaced hydraulic, which hung from steering column. Wiring, workmanship is light and neat, easy to get at.



Not much luggage room. Trunk holds six gallon main tank and 2½ gallon reserve. Small tank is removed to save weight on short races. Lightweight six-volt battery is in rear to improve front/rear balance.





Rear suspension hasn't changed from first chassis version. Leading quarter-elliptic springs and trailing arms from lever shocks give straight vertical motion to stock Crosley axle.

PORSCHE owners the world over are known for their maniac devotion to maintenance, but up and down the West Coast there's a scattered string of perennially dusty 356's. A Porsche Duster has been at work, and not under cover, either. In broad daylight a red shoebox-shaped machine has kicked up enough asphalt shreds to lay this layer in the hands of its owner and builder, Harry Eyerly of Salem, Oregon.

Starting with the Pride of Cincinnati, the Crosley, Harry built the mostest Class H dominator for the leastest outlay imaginable. Back in the fall of '52 when the car was first conceived of as a small runabout, it was to be powered by a detuned 45 inch Crosley mill taken from one of the Eyerly hydros. Harry had had a scad of experience with the high winding engines and knew exactly what could and couldn't be done with them. He had also fooled with a Crosley Hot Shot and was impressed with the potential of the car, though not with the engineering of the chassis. His idea was to improve on the rigidity and lightness of the chassis, up the stock performance of the engine slightly and have an all-American runabout.

With nothing more serious in mind, he felt that plain, mild steel would do for the chassis instead of the usual expensive Shelby tubing. 2⅜ inch O.D. tubes were cut and laid out to a preliminary sketch. When welded together the frame formed an extremely rigid platform consisting of three rectangles, one small one in front to carry the engine and front suspension, a big one to carry driver and passenger, and a small one at the rear to carry the rear suspension. The length and width of the front and rear rectangles were dictated by the Crosley components, a stock front axle complete with semi-elliptical leaf springs, and a stock rear axle carried on the leading-end of ¼ elliptics. Engine mounts were located well back in the frame so that the stock "crash" box and a shortened torque tube drive could be utilized. A cross tube was welded to the front frame kickups to carry the steering column, and a set of master cylinders for the hydraulic brakes and the hydraulic clutch. The stock steering box was mounted on the right side of the frame and employed a cross-shaft to actuate the lengthened pitman on the left front wheel. A sturdy, braced roll bar was located just in front of the rear kickup to give driver protection, strengthen the frame and to provide a basis for locating the ⅝" tubing used to form the body.

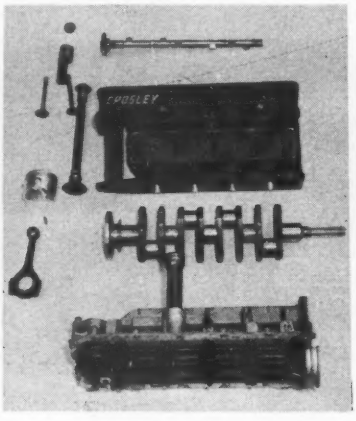
For the power plant, Harry selected one of the 45 cubic inch cast iron block engines that had been used in his hydro. The mill was an all out Alky burner that was designed to turn up to 10,000 rpm. For street use the engine was detuned by lowering the compression ratio to 9.5/1. Stock valves, cam, and rods were used with high dome pistons, a steel billet shaft, aluminum flywheel and a reworked Crosley clutch. The parts were given a light going over with a high speed stone to make them smooth and the intake valve seats were recut to a 30 degree angle. Battery ignition

Though Harry hasn't been able to campaign in the east, his Crosley certainly cleaned up in the west after shakedowns in 1953 racing.

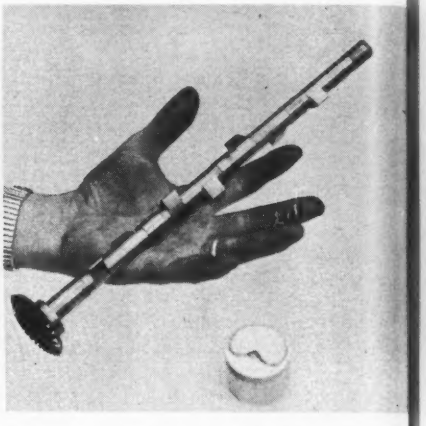
was used. Harry built a simple log manifold to carry a single Ford "60" carburetor. All moving parts were balanced statically and dynamically before being assembled. The mill was dropped on its mounts and buttoned up to the stock transmission. To complete this stage of the work Harry mounted a Crosley radiator on a bracket between the engine and the steering cross tube.

A simple yet serviceable body was then designed to cover the chassis. Since Harry had elected to do all the work on this project he felt that it would be best not to design a complex body for the car. Instead, a simple envelope employing one-direction curves was laid out on the drawing board. A framework of 5/8 inch tubing was then welded up to the chassis. Over this the skin, formed from sheets of

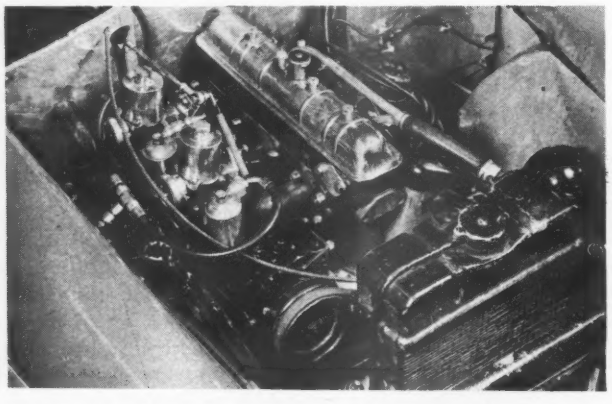
Special high-compression piston has butterfly-shape crown to accommodate turbulence wedge in block.



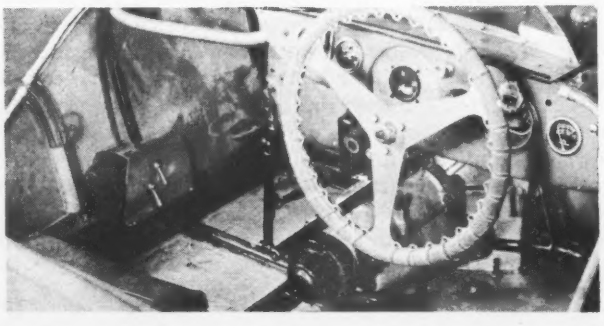
Norden steel billet crank, latest crankcase and block are heart of going Crosley. Rod is as stock.



Suitable for both boat and car use, Isky B cam won Eyerly's favor. This is billet grind, has fine finish.



Twin SU carbs were pirated from a 40-inch Triumph cycle, have performed faultlessly with original needles. Throttle linkage is simple, sturdy.



Wheel is rugged, grippable, instrumentation simple. Twin valves for main and reserve fuel are at left, feed Bendix electric pump. Nothing for show here.

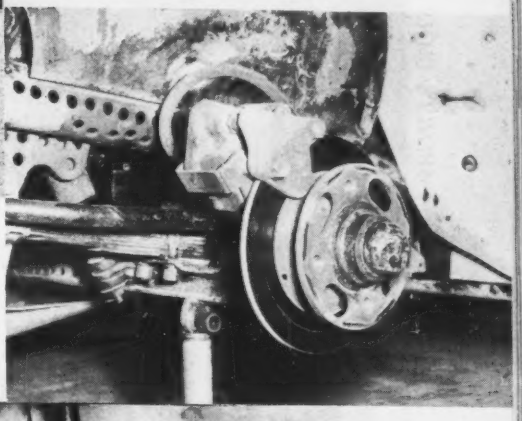
.032 24 ST aluminum, was laid and secured by self-tapping sheet metal screws. A hood and grille was fashioned from a single section and so formed that it could be hinged at the front. When lifted it would give access to everything from the instruments forward.

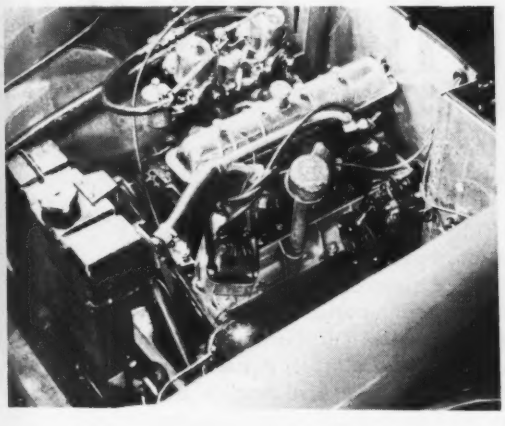
When complete (early in '53) the engine was fired up and the car driven on its maiden run. With an all-up weight of less than 1,000 pounds the bright red roadster performed handsomely. In fact the roadability was nothing short of amazing, considering its modest layout. The power to weight ratio was such that the car could be walked in high cog, or when dumped into second, scream away like a scalded cat.

Later that summer, after novice races at Pebble Beach and Stockton, California, the sports car fever really took hold of the Salem lad and when entries were filed for the Golden Gate go at San Francisco he made sure that his mount was duly entered. The officials placed the wee car dead last in the pack. Four Porsches made up the hot competition and were placed up front in the first two rows. The flag dropped and the 24 entries roared off into the first turn. Two minutes later the first Porsche came around the last turn into the home straight. Right behind, practically bumper to bumper, was the Eyerly Special. And, there it stayed, until, on a downshift the actuating rod of the hy-

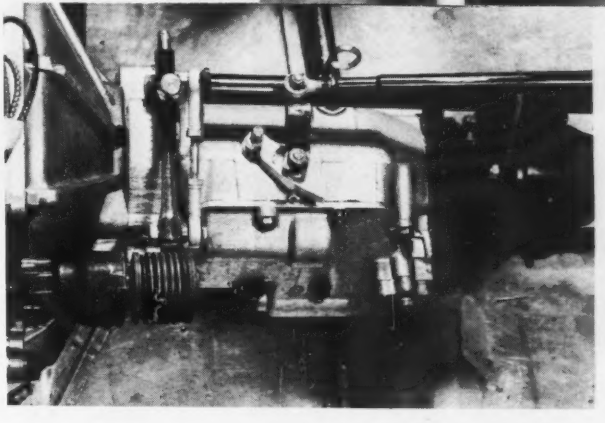
SCCA demanded fender valances. Rear rims were widened from 4 to 5 inches to take big dirt track casings. Termites were at work.

Goodyear spot brakes, made for Crosley under Hawley patents, have been positive and trouble-free.





Wico mag sparks mill; weight is cut by drilling starter and generator. Two water leads replace stock central outlet.



Jowett Jupiter box requires odd shift linkage, is fitted to bell housing by one-inch plate. MG center spline adapts Crosley clutch.

draulic clutch master cylinder jammed and left Harry in low cog.

Fired by this near win, Harry brought the car home and, forgetting the runabout theme, set about to make his car a real contender. The car had lacked the top end performance to pass the fastest Porsche. The induction and exhaust systems were obviously the weak points. To remedy these weaknesses the single pot and log manifold were discarded along with the single stack exhaust system. The engine was dismantled and the area around the valves relieved with a special stone. The rods were lightened by grinding off all excess metal on the big ends. An Iskenderian cam was installed when the engine was assembled. The stock ignition was discarded and a Wico mag mounted in its place. Then a pair of motorcycle MC-2 S.U.s were bolted directly to the intake ports via fabricated double flanged tubes. No balance tube was employed. Next an exhaust system employing a separate pipe for each port was composed and the tubes were made to run along the right side of the car. A deflector was used to keep the exhaust gases off the rear tire. On long races the oil temperature had a tendency to climb so a scoop was fashioned to direct a stream of air over the crankcase. Oil capacity was increased by cutting away the front of the case and adding the bottom half of a '42 Crosley case. The added sump was completely finned to place more area in the path of the cooling air from the scoop. Harry then began to lighten the chassis. Everything was drilled. The wheels, frame, starter, generator—every non-essential ounce of metal was pared off the car. End result: ready for the road the car scaled in at 760 pounds.

Running in the '53 Seafair at Seattle, Washington, the little car thrilled the spectators, and its driver, with a sizzling performance. But, just when victory was in sight the load proved to be more than the Crosley rear hubs and axles could take. On a hard turn the left rear wheel let go and the race was lost. To eliminate any further failures of this type Harry made new rear hubs from steel. And, even these are replaced after every three races. The stock Crosley box did not prove troublesome, but the ratios were inadequate, especially between second and top gear. The rear tires were changed to five by twelve inch dirt track casings that allowed a higher speed without taking the mill past the 7,500 mark.

The car was run the entire '54 season without a single failure. Class H became the personal property of the Eyerly Special. Nothing could touch it. With the opening of the '55 season, though, Harry began to use the rig for more than just pure competition work. Rallies of all types were entered. The outfit was run in the same form except for the addition of a passenger's wind screen and a muffler.

(Continued on page 58)

Lt. Col. G. Gardner rests six foot three frame on cane. For his 61 years, he has unbounded energy.

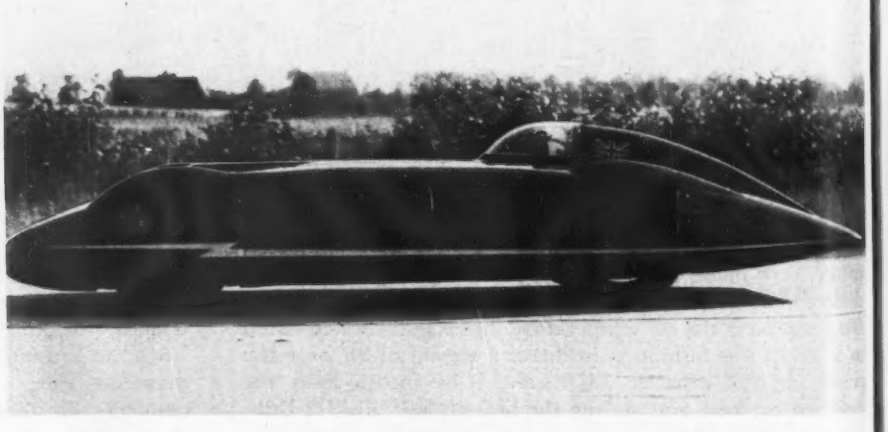
THE COLONEL AND THE FLYING HAMMOCK

By DENNIS MAY

A MAN doesn't have to be an authority on cooperage and hydrodynamics to be pushed over Niagara Falls in a barrel; and the career of Arthur Thomas Goldie Gardner is living proof that ignorance of automotive technicalities is no bar to the record-breakers' Hall of fame.

As the first and only driver to reach 200 miles per hour in the 1100 and 1500 cc categories, also the first to click the century and a half turnstile on 750 and 500 cc, he was the central figure in exploits of a technical merit at least equal to the Land Speed Record itself. Yet among his entourage of egg-heads there wasn't one who'd have let him check his own tire pressures. "The Colonel" had the courage of 37 Gunga Dinns—and he did what he was told. It was enough.

It was enough except on occasions when, through some oversight, the self-evident was not explained to Goldie. Then anything could happen. One such time was Wednesday, November 9, 1938, memorable as the date of the first records he ever made with EX 135, his MG streamliner. He had raced through the mile and kilometer traps on the Frankfurt-Darmstadt autobahn at a decimal below 180 mph

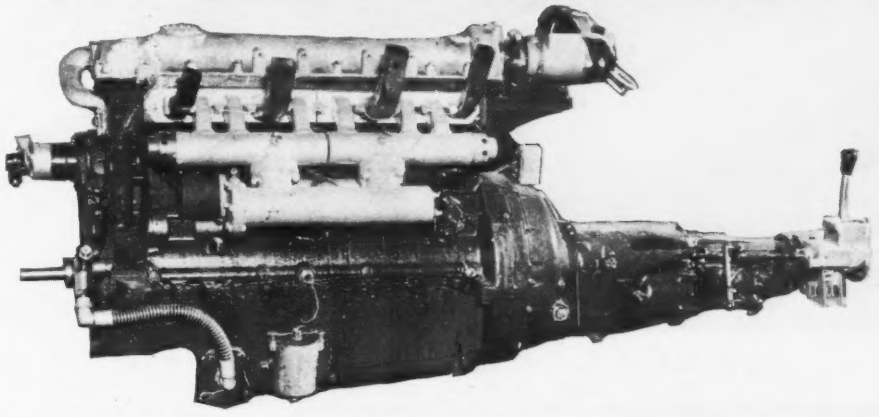


The Ex135 in postwar condition just before a run on the Jabbeke Highway in Belgium. In prewar days, the cockpit dome did not cover the driver's head completely. Wheel covers restricted front wheels to 18 degrees lock to lock.

Photos Courtesy of The Autocar

Photos Courtesy of The Motor

Part of the mile trap on the Jabbeke Highway. Most of the Colonel's successful sprint records were run here.



The experimental six. Overhead cam is driven through bevel gears. Supercharger is driven by crankshaft.

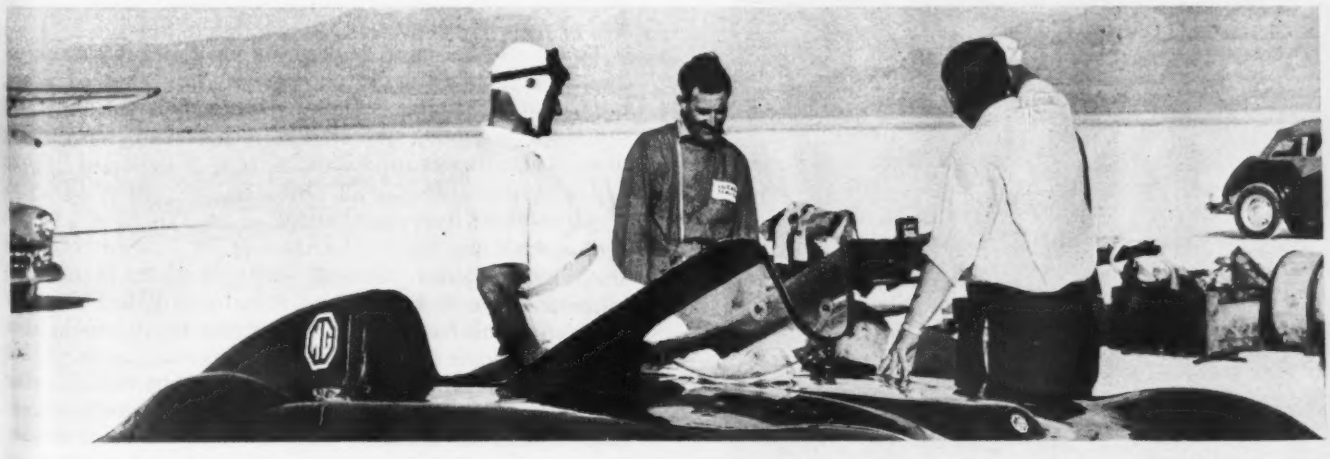
average. Past the end of the timed stretch, at a point where the car's speed would still be up around 170, an MG engineer had established a one-person observatory on the sidelines. At Gardner's approach the MG man took a couple of paces out on to the pavement and waved Goldie the top 'o the morning. EX 135 had back wheel brakes only, and these were totally devoid of ventilation. But, since nobody had thought to tell the Colonel that you don't hit such brakes at 170, he hit them, with might and main. By a remarkable combination of luck and legerdemain, he brought the streamliner to a standstill without doing a loop . . . just. Always the personification of *phlegme Brittanique,* Gardner had fully recovered his composure by the time the anxious technician came panting up.

"Tell me," he said, "what gear am I in?"

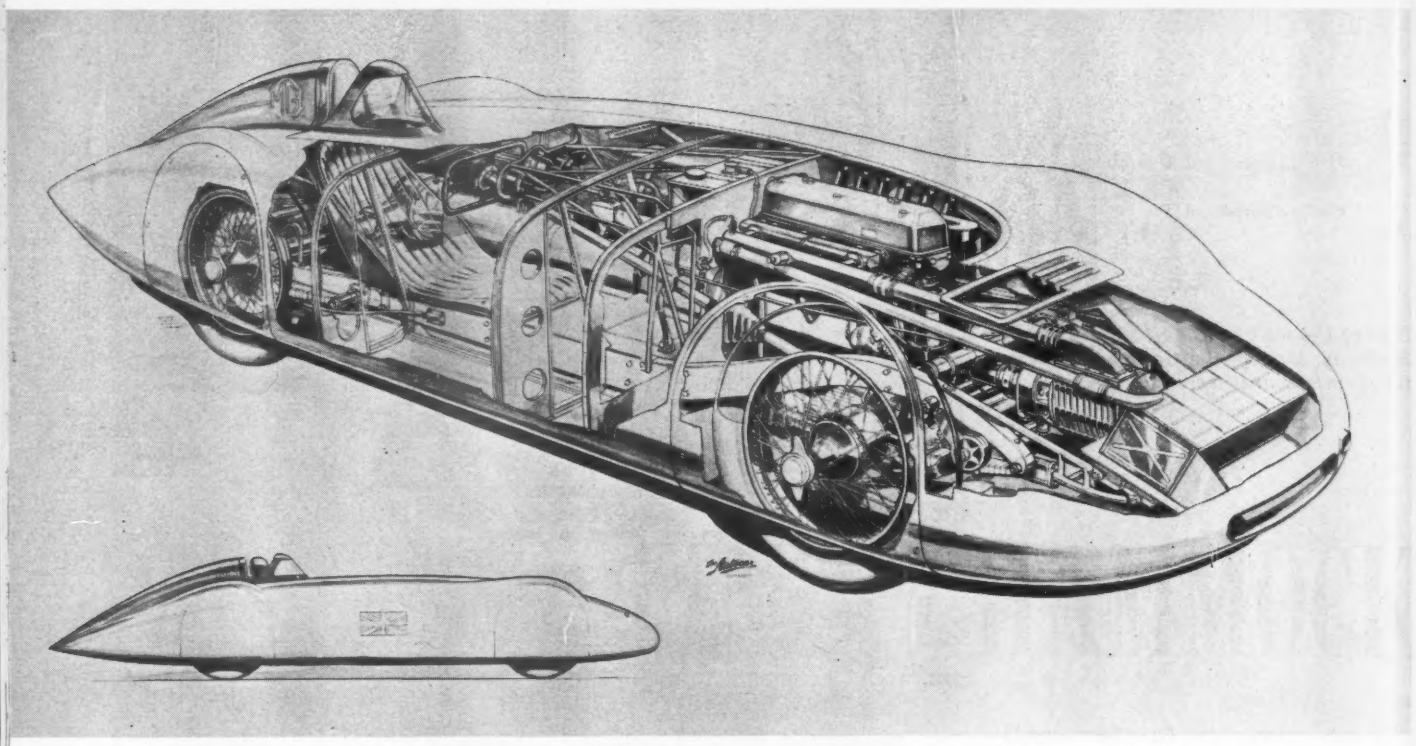
This suicidal act of braking, and the quaint question that followed it, might have been credible in a novice. But Goldie had been driving cars of all types and nationalities for over two decades, and racing fourteen years. Before acquiring EX 135 in 1938, he was already the holder of the 1100 cc lap record for Brooklands track at better than 124 mph, and an earlier autobahnstorming trip with his first Magnette, an offset-bodied monoposto, had given him the world's fastest Class G speed in 1937.

Many years later, in a place far removed from Frankfort-am-Main, the Colonel gave his aides the last of many reminders that he was no Uhlenhaut. After two turns of a ten-mile circle on the Bonneville Salt Flats, in quest of Class E records in '52, he pulled out and worriedly reported that the oil thermometer hand was now on its second lap of the dial. Disproof of this novel contention did not defeat the brains of Sydney Enever, Chief Engineer of MG, whose technical skill had contributed more than any other man's to EX 135's long and varied list of record kills.

With the close of this Bonneville chapter, Lt. Col. A.T.G. Gardner, O.B.E., M.C., took the weight off the MG's canted-back hammock seat for the last time. Ill health forced him to abandon plans for another Utah expedition in 1953; and it was *finis* to a man-and-machine partnership that had lasted nine peacetime years, bridged a world war and set



Unable to scrape the slick salt from his shoes because of his stiff leg, Gardner has his soles dusted off. Crusted salt on shoe bottoms has a gooey, oily feel on the pedals, which can be an annoyance during runs.



Cutaway of the Ex135 bares the supercharged power plant which pushed the Gardner machine to successive records. Built on an MG K-3 Magnette chassis, with leaf springs fore and aft. Note the lack of front brakes, and sling seat.

Goldie had to adopt a 40 degree backward lean in the postwar Ex135 otherwise cockpit cover would have projected too high to meet aerodynamic requirements.

Gardner lifts himself out of cockpit of MG after a successful burst at Jabbeke. Rectangular steering wheel was removed to permit the Colonel's release.

fastest-ever marks in 60 percent of the recognized international classes, from 350 cc to two liters.

Ironically, although the 1952 edition of EX 135, powered by a blown TD engine of basically stock pushrod type, took American national records at over the double century, Gardner was cheated by a tantalizingly narrow margin of his real target; this was to beat his own thirteen year old Class F marks—203.5 and 203.2 mph for the mile and kilometer set in '39 with six cylinders and a single overhead camshaft under the carapace.

Those figures still stand, pride and consolation of Europe's greatest living record-man as he whiles away his retirement in a prim English coastal resort. Conditioned to action and danger by more than forty years of adventure in war and peace, on fast wheels and in the cannon's mouth, the Colonel, at 66, accepts his perforcedly humdrum state stoically. For company, apart from the old racing friends who drop by to trade shoptalk, he has his two steadiest fans—a charming and devoted wife, many years his junior (his first marriage, to an American girl, lasted only a short time) and a nine year old daughter.

To occupy his mind he has his memories, his books, a mountainous inventory of photographs (souvenirs of record campaigns in Britain, Germany, France, Belgium, Italy and the U.S.) to catalog and classify and marshal into orderly mural patterns, his trophies of silver and gold to arrange and rearrange, his scale models of the departed EX 135 which serve as three-dimensional food for nostalgia.

"A gentleman to the ferrule of his walkingstick" was the most apt description of Gardner I ever heard. The allusion to the stick was more than incidental. This accessory, which he has a habit of hanging by its crook from one of his jacket pockets when standing easy, is the symbol of a physical handicap that has dogged him with varying degrees of rigor for nearly forty years. Every race he drove, every record he attacked, had its accompaniment of unpleasant sensation ranging from nagging discomfort to acute pain. I was with him on many races and record

sorties, at home in Britain and abroad in Belgium, France and the U.S., and I never heard him utter more than an undertoned grunt of complaint.

With a crippled right leg and hip like his, lesser men would have had all the excuse they wanted for leaving record-breaking alone; Goldie, on the contrary, made it his reason for getting *into* this department of speedwork. When his injuries robbed him of the freedom of movement demanded by road racing he just switched to a branch of the business in which he'd only need agility for crawling out from under in the event of wrecks.

He copped the original damage in a flying accident while on home leave from France in 1917. Following a two year lay-up in a hospital and twenty operations he was ruled unfit for service and discharged from the army. A man's fitness for automobile racing, however, is naturally his own affair, and medical opinion was therefore not invited when Major A.T.G. Gardner made his Brooklands debut in the summer of 1924, driving the species of Austin Seven known as a Gordon England Special. How, with his seventy-five inches of stature and a right knee devoid of a knee-action, he ever shoehorned himself into it remains a mystery, but he did. And the immediate successors to the G.E. Special, a Salmson, an Amilcar and a Montlhéry Midget MG, weren't much roomier either.

Not content with the interim job they'd made of lousing up his leg in '17, Goldie's gremlins tailed him to the Ards circuit, Northern Ireland, in 1932, and tried again in the Tourist Trophy race. This time they weren't playing patacake. Crowded off on to a grassgrown shoulder while maneuvering to pass a slower driver on a fast turn, he hit a transverse gulley with his front wheels. The Midget went end over end three times. At the second inverted landing it came down on top of him, inflicting a compound fracture of the right leg, close above the knee, and other injuries of a lesser order. His helmet split open like a nutshell under the impact but nevertheless saved his life.

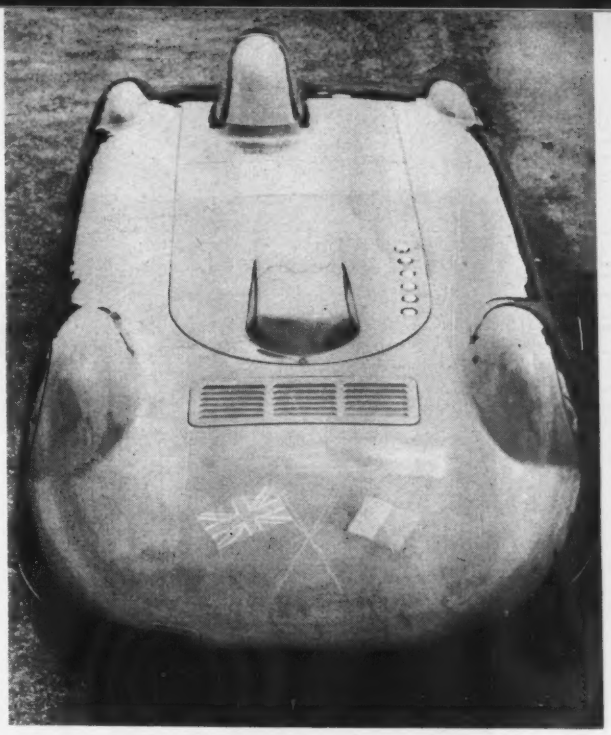
Complications set in, including septicemia, and for weeks it was touch and go whether amputation would be necessary. Finally the surgeons managed to conjure some semblance of life back into the limb and after four months in the hospital Gardner returned home, still classifiable as a biped . . . just. On this point, incidentally, some British newspapermen took a lot of convincing; right up to the time of his first 200 mph bursts in 1939, the non-technical press regularly referred to Goldie as "The One-Legged Major," occasionally ringing a change with "The One-Legged Speed Ace."

The apellation "Major" at least was accurate at that date. It wasn't until his WW2 spell of service with the Royal Artillery that Gardner rose to the rank of Lieutenant Colonel. As such, of course, he wasn't and isn't officially entitled to be addressed as Colonel, but with his rather naive regard for the grandiose he was not the man to disown this extra-military promotion. When he was in Italy in 1946, shooting at 750 cc records, an Italian factotum attached to his equipe elevated him to Sir Colonel Gardner, then to Mr. General Gardner. It is not on record that Goldie corrected him.

To get a proper perspective on the 24-carat guts of the man, all of his speed exploits between 1924 and 1952 inclusive have to be viewed in the light of his disability. That Ards clobbering, needless to say, did nothing to improve the already ricketty leg. From then on the pain spasms were worse and more frequent, and usually came at the least convenient times. Nevertheless, except for when he finally submitted to doctors' orders and quit speedwork for keeps in 1953 — through a health deterioration unconnected with his leg — he never cancelled or even postponed a record bid on account of his handicap.

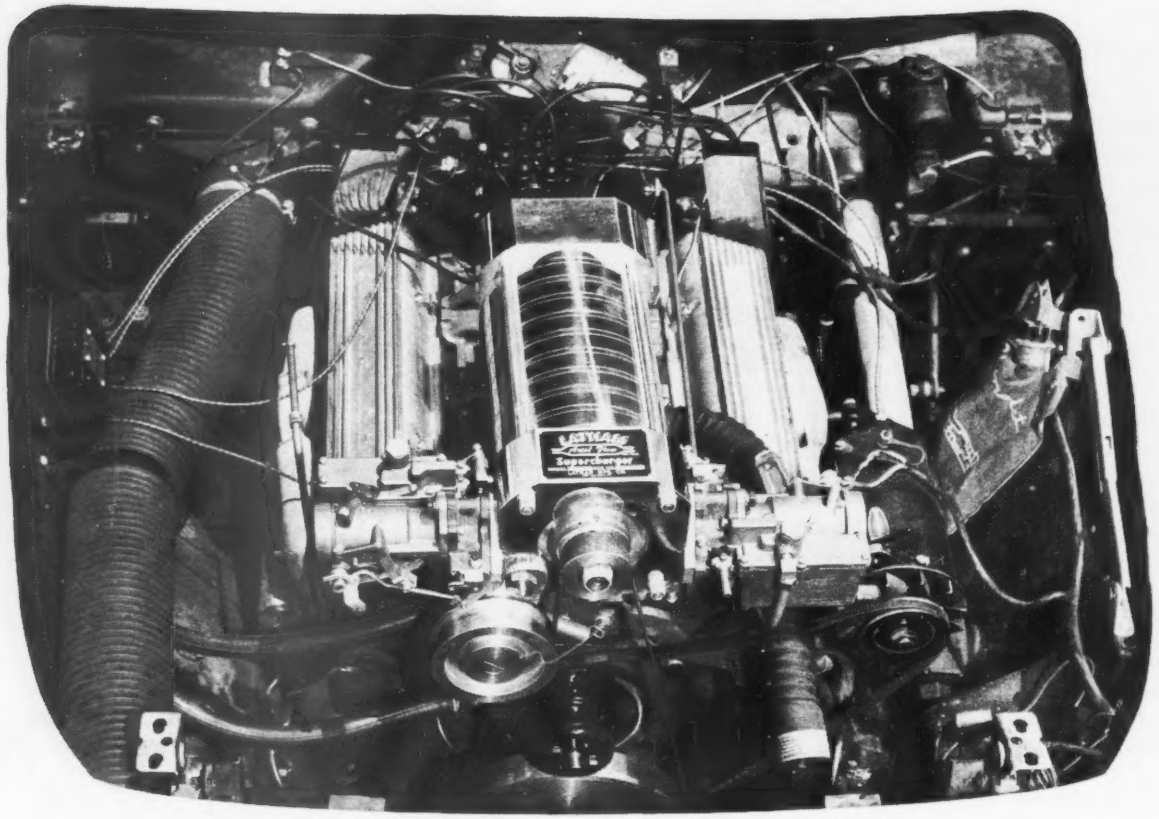
Short as he was on engineering knowledge, Goldie was

(Continued on page 52)



The beautifully aerodynamic form of the Ex135, designed by Reid Railton, is probably the most copied of all streamliners. Note offset seat, and vertical exhausts.

ABOVE: Goldie wriggles into flying hammock preparatory to jumping off. BELOW: Col. shades his eyes against Belgian sun as MG technicians talk over spark plug problem. With straight hair, right, is R. Jackson.



A big one-step boost for the Corvette is given by the Latham axial-flow blower, belt-driven and fed by two Carter carbs.

By ROGER HUNTINGTON

HEATING UP THE HOT ONE

"THERE'S no substitute for cubic inches." That's a popular theory among American auto enthusiasts which eight years of bigger and bigger passenger car engines have done nothing to kill. That is, until the little 530-pound, 265 cubic inch Chevrolet engine came along. After two years of experimenting with this fireball, a lot of smart hop-up men aren't so sure about the pet cubic-inch theory. They're beginning to realize what the Europeans have known for years—that a good, big handful of *usable* rpm can replace a lot of inches.

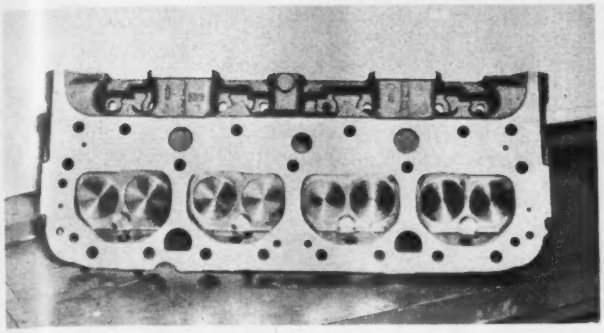
This is the double whammy that the Chev engine has on the other V-8 powerplants throughout the industry. It has about another 1000 rpm of usable crank speed that can be turned into brute horsepower at the road wheels. Furthermore, it's considerably smaller and lighter than the competition. It's an ideal powerplant, either for hopping up in a stock Corvette or Chev passenger car or for transplanting into other sports cars and specials. It will be easier to get one horse per cubic inch out of this mill than anything else you can lay your hands on this side of the British and Italian sports car factories.

Here's how . . .

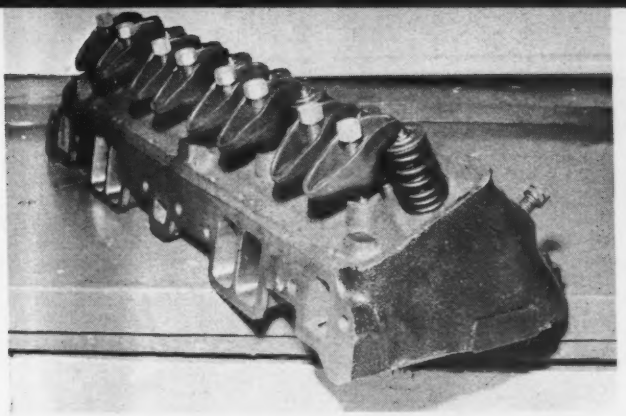
FIRST THINGS FIRST

Before we go any further, take note that the Chevrolet V-8 must not be considered a "big, high-torque Detroit engine." So many sports car enthusiasts, used to thinking in terms of one to three liters, look upon all American V-8's as big, hairy iron with enough low-end torque to pull the skin off an elephant. The Chev is not in this category. Cubic inches are the prime factor in low-end flexibility and peak torque —and the Chev just doesn't have 'em. Even when bored and stroked near the practical limit—around 320 cubic inches, it isn't big by Detroit standards. So it might be good to try to picture the Chev V-8 somewhere in between a 350 cubic inch Detroiter and a two-liter European sports engine. In other words, we can profitably increase displacement with an eye to improving torque and flexibility, but we're never going to get a "top gear" powerplant. Modifications aimed at utilizing the high rpm potential to develop *horsepower* will pay off more.

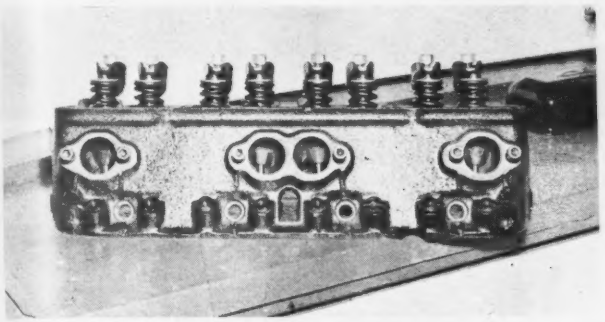
By the same token, this engine is always going to want use of the gear lever. A good "bread and butter" rev range for quick road travel is 3500 to 5500 rpm. With proper modifications the 4500 to 6500 range can be used for com-



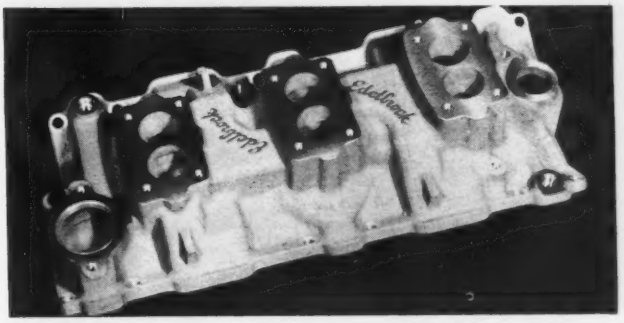
Polishing Chev chambers and lightening valves is worthwhile. These intakes are stock, while exhausts were recut to take 1.625 inch valves.



Credit for rev-readiness is often given to light, simple stamped rockers. Double valve springs, rated at 200 pounds, are final touch. Ports are smooth.

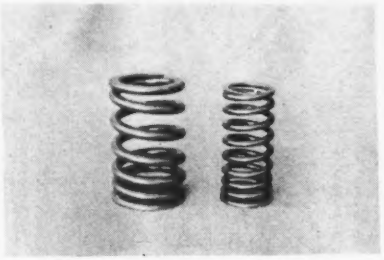


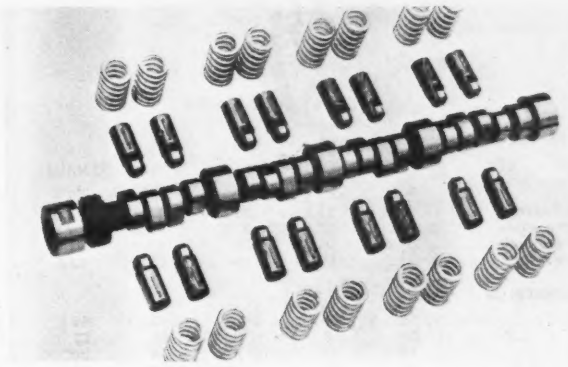
Exhaust ports can be hogged way out. These were once square! Valve guide bosses are kept healthy, for stem protection. Allen cap screws hold manifold down.



Best carb setup for Chev so far is Edelbrock's 180 degree triple-twin-throat manifold. New progressive throttle linkage keeps it tractable on the street.

McGurk's special Chev valve springs give 260 pounds pressure with valve fully open.





All-out versions usually justify added cost of roller cam kit. Weber set is distinguished by slot-type tappet location. Broad lobes don't always mean wild timing.

petition—and this can be extended under some conditions. All this means that items like head reworking, plentiful carburetion, hot cams, light valve gear with proper spring tension, etc. will probably give more results *per dollar* than boring and stroking.

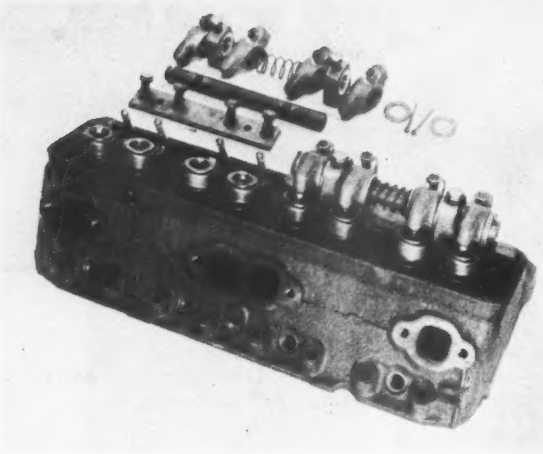
Let's look over these categories in more detail:

BORING AND STROKING

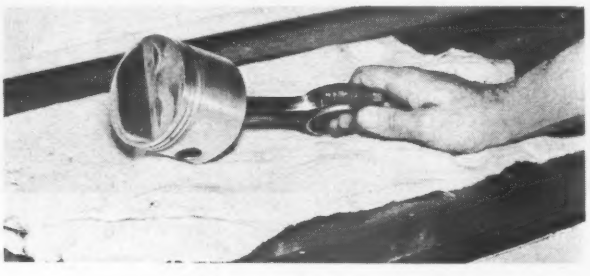
The '55 to '56 block, with 3¾ inch bore, can be safely overbored a maximum of ⅛ inch. The '57 block, with 3⅞ inch bore has been recored to give, in effect, thicker cylinder walls (with the same bore center-to-center distance). However, the new walls are not quite so thick, so about .100 of an inch would probably be a safer maximum overbore. A block with very little foundry core shift can be bored to four inches.

Pistons for these large oversizes are widely available from a number of California supply houses—Speedomotive, Turner, J. E., McGurk, Venolia—and can be had for almost any desired stroke length. These can be ordered as heavy-duty racing pistons, with wide, noisy clearances and some additional oil pumping, or as a milder, less-expensive road type. You should consider "pop-up" domes as a simple, fool-proof way of increasing compression ratio without the problem of head milling. Most of the piston manufacturers will put domes on your pistons for any desired compression, and they will also fly-cut for proper valve clearance. Be sure to specify bore and stroke, type of cam, etc. Prices for a set of these special pistons, including rings and fitted pins, generally run from $60 to $100.

Stroking, as you know, is the practice of building up the crankpins by arc welding and then grinding them back down to size on a center that is offset away from the crank axis a distance of one-half the desired stroke increase. About the only limit to the stroke length obtainable this way is interference between con rods and cylinder walls (though some engines will foul cam lobes). Chev V-8's have been stroked ½ inch, though ¼ inch is more usual. A stroke increase of .22 inch in conjunction with a 3⅞ inch bore will give 304 cubic inches up to the limit of Class C modified. The '56 Sebring modified Corvette had a .25 inch stroke to put it in Class B (307 cubic inches). The crankshaft companies like Ansen, C. & T., etc. usually sell a stroked crank as part of a complete kit, including pistons, rings, pins, con rods, and bearings. The whole assembly is carefully balanced before



If you don't trust those stampings and studs, this shaft kit with cast magnesium rockers might be the answer. Thomas makes it, to bolt into old stud holes.

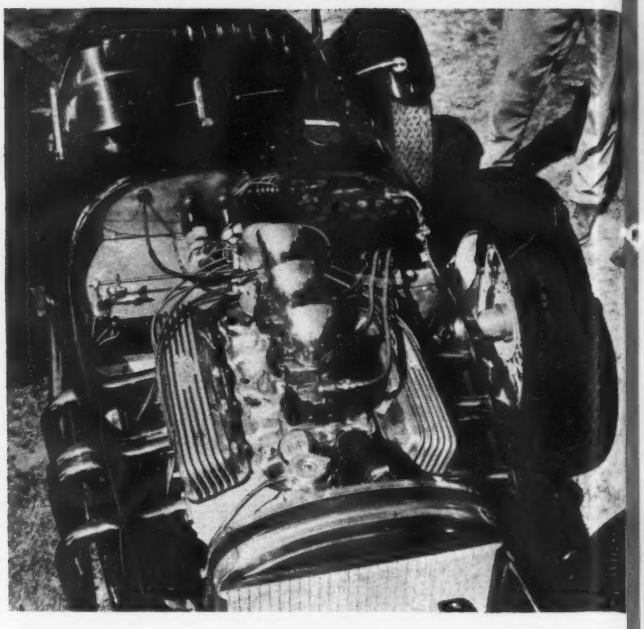


Rods can be lightened with care and polished. Domed section on full-skirt JE piston raises compression, while "eyebrows" clear valves.

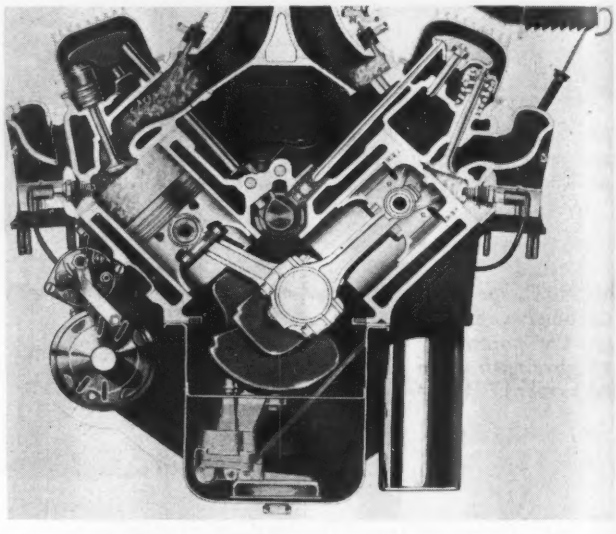
CHEVROLET CAMS

1956 FACTORY

		INTAKE			EXHAUST	
CAM	BTC	ABC	LIFT	BBC	ATC	LIFT
Standard	18.0	54.0	.334	52.0	20.0	.334
Powerglide	26.5	63.5	.373	66.5	23.5	.373
Powerpack	31.7	92.5	.396	69.6	37.0	.396
Corvette	21.5	62.5	.404	62.5	23.5	.414
ISKENDERIAN						
02A	12	54	.385	52	14	.385
E-4	20	60	.400	58	22	.400
E-2	18	58	.410	56	20	.410
#2 L.D.B.	26	65	.410	64	27	.410



One of goingest Chevs around, the Carstens HWM engine was dyno-tuned and fully equipped at Edelbrock's shop.



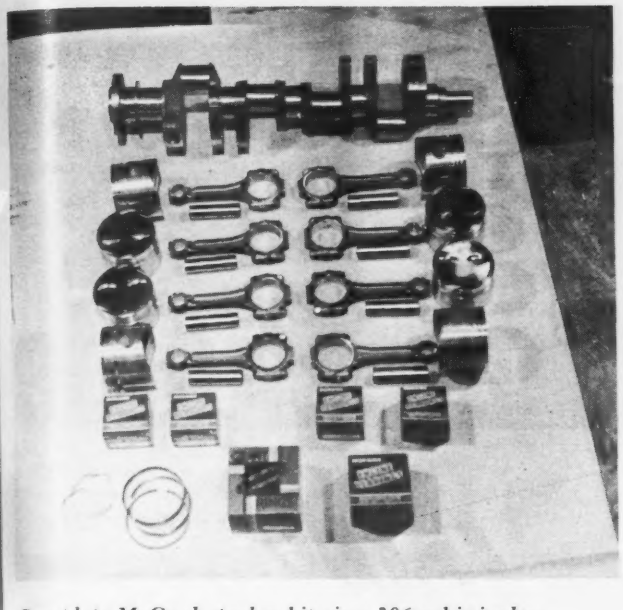
Factory "Ramjet" fuel injection is more for publicity than power. Nozzles are long way from ports, and act as small carbs at idling. Fuel metering is accurate.

shipment. This seems to be the best, most reliable way to go bigger—that is, bore a moderate amount and get the full stroker kit. Prices are steep—$300 or over for the works—but torque increases are very gratifying. Also, the balance job is a must for high rpm.

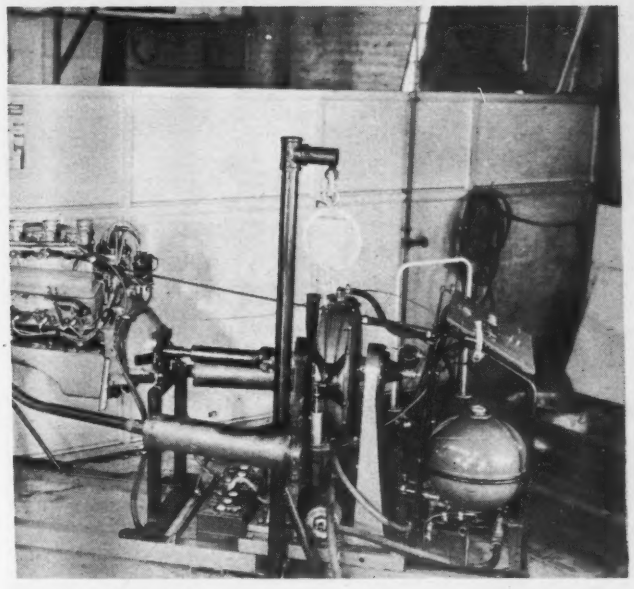
HEAD REWORKING

You can go shallow or deep into this job. The Chev V-8 already has generous valve sizes in relation to its displacement, so doesn't respond to diameter increases as well as some engines. Intakes are 1.72 inches head diameter, and exhausts run 1.50 inch. One simple trick that will help, though, is to enlarge the port diameter *under* the valve. Production engines have valve seats over ⅛ inch wide (a lot wider than is needed to seal the cylinder) to allow for machining errors and core shift. It's easy to sink a 70 degree reamer down into the port, using the valve stem bore as a pilot, to open up the port diameter until the seat is reduced to a width of around .050 inch (around the outside edge). You can bring the seat out still closer to the valve edge by grinding the seat itself with a 45 degree stone (also piloted in the stem bore), and then opening up the port still more with the 70 degree reamer. These cuts must then be blended into the head surface and port passage with a hand grinder. If desired, you can also turn some stock off the under side of the valve heads to take full advantage of the narrower seats (see drawing).

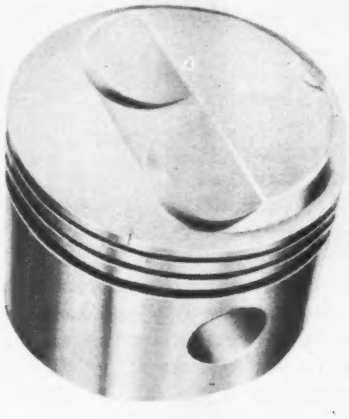
It is possible to get ⅛ inch larger intake and exhaust valves into this combustion chamber. The modified Corvette with which Arkus-Duntov cracked 150 mph at Daytona a year ago had ⅛ inch oversize intakes and exhausts made by Thompson Products. These special valves are not available for general distribution, so most of the boys use 1.88 inch intakes from '53 and later Chevrolet Powerglide six-cylinder engines. This has the same stem diameter (.3419 inch with .0019 clearance) and can be adapted by shortening to the length of the V-8 valve. Regroove it to accept stock spring keepers, and reharden the valve stem tip after cutting off. These valves have a 30 degree seat angle, so the outside diameter of the seat must be enlarged to about 1.85 inch with a 30 degree stone and then the port bored out with the 70 degree reamer to bring the seat width close to .050 inch.



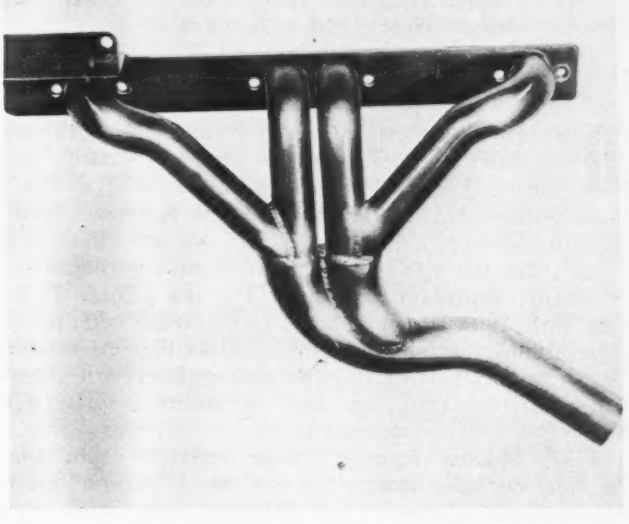
Complete McGurk stroker kit gives 306 cubic inches, retails for $300. Fully balanced, of course.



306-inch engine on McGurk's dyno had works, showed 298 bhp at 5500. In sedan it turned 102 at drags!



High dome and deep valve cutaways are cast into special McGurk piston for big-bore Corvette. Resulting ratio of full-skirt slug is 10/1.



Hedman "Hedders" for Chev are clean and well-designed. They're particularly good with pre-1956 cylinder heads.

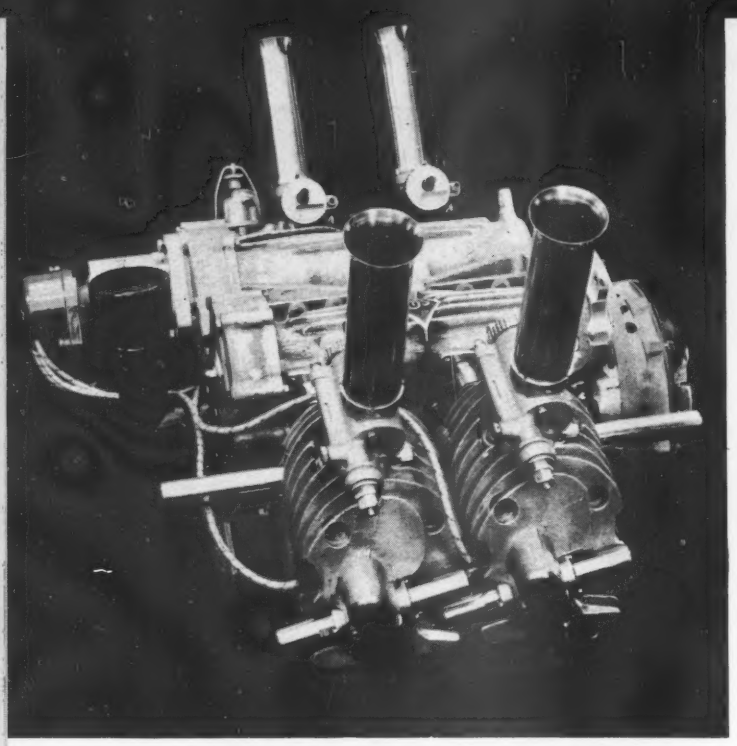
Exhaust valve diameter can be increased to 1⅝ inch by using late Lincoln V-8 valves; these have a compatible stem diameter (.3414 inch with .0024 clearance) and can be adapted by shortening and regrooving as above.

And don't forget to clean up the rough port surfaces with a hand grinder. Port walls are pretty thin on the Chev engine, so don't go too deep. The stock section areas are good anyway, and the goal should be a constant area. The later '56 Corvette engines came through with cast-larger ports, achieved by modifying foundry coring. If you have to buy a set of heads, look for these. Even if you don't want to go to the effort of doing a thorough porting job, it's always a good idea at least to *match* the ports in heads and manifolds.

Then there's the matter of head milling. The Chev heads don't have the meat in them that some have. A cut of .090 inch should be considered the absolute maximum. This will raise compression about 1½ ratios. A mill of more than about .060 inch on '55 heads and .020 inch on '56 Corvettes will cut into the valve seats and cause piston-valve interference, so the seats must be recessed for the very deep mill job. Again, pop-up pistons are the answer. A cut of .060 inch on the '55's will raise compression ratio one point, which is usually all you can handle. When doing any head milling on the Chev engine always check for piston-valve interference since it occurs readily and will vary with cam rates and lift. Most of the Corvette V-8 pistons, including the factory SR slugs for use with the Duntov cam, are fly-cut notched on the heads for valve clearance. They usually have small shoulders cast on the underside of the piston heads to allow somewhat deeper cuts if needed. Possibly the neatest way to increase the compression of a '56 Corvette engine is to bore ⅛ inch and use stock pistons. This would give 283 cubic inches and a compression ratio of 10 to 1. Similarly, the 9.1/1 '56 heads give a 9.5 ratio when clamped on the '57 block.

I don't recommend ratios much above this for the Chev V-8 on 96-98 octane premium pump gas. Its octane requirement in relation to compression ratio is not the lowest in the industry. A lot of fellows who have tried to use 11/1 for the street, as many are doing with other V-8's, were sorry. The '57 fuel injection jobs are able to use more compression because of the more even fuel distribution between cylinders.

(Continued on page 56)



The AJB Formula I engine (2½ liters). The projecting chromium-plated tubes are covers for the torsion-bar valve "springs". Note induction-tuned intake.

Archie's Unbreakable *four*

by ALBERT DOUGLAS

IN these days of giant production amalgamations it comes as refreshing news that one man is setting out to show the motor racing world that a new type of competition engine can be designed and built—with a likelihood of racing success. This is no new "flash in the pan", but the result of over five years experiment.

Archie Butterworth, man behind the project, is Irish by birth. With a pointed beard and a French beret perched precariously over his left ear, he looks the real eccentric, but is in fact a thoroughly practical engineer with a wealth of theoretical knowledge and the ability to drive a car fast—as his racing successes prove.

The armored fighting vehicle research depot where Archie was based during the war was a "natural" for the discussion of advanced ideas on internal combustion engine design by some of the finest technical brains in the country. Many of these men had served their "apprenticeships" with racing cars in pre-World War II days at Brooklands, Donington and on the European Continent. During one of these wartime discussions with Rex Sewell, one-time member of the old Bentley design staff, Archie's idea of the "swing-valve" for four-stroke engines was born. The other "bee in his bonnet" was the desirability of air-cooling for engines. He couldn't see the reason for transporting a radiator, heavy castings and a quantity of water around when experience with aircraft and other power-units suggested that equal, or even higher efficiency, can be gained without them.

The end of the war gave Archie his opportunity to build his first racing engine. Vast quantities of war material were being disposed of at prices that represented a fraction of their original cost. Among the disposal stocks was a quantity of German "Snowagen" engines, in which Archie could see great possibilities. The engines, built by Steyr, were air-cooled 3.6 litre V8's with a power output of around 85 bhp.

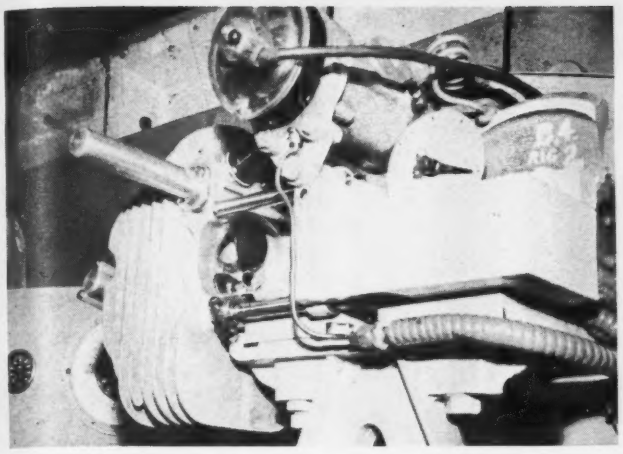
Archie had long expounded the theory that ultra-high power outputs did not necessarily spell race wins. He opined that impressive torque figures synonymous with rapid acceleration were more instrumental in putting the car in the money. He still adheres to this sound theory; but, even so, it wasn't long before the Steyr V8 was developing the respectable figure of 280 bhp. This was comparable with the unblown Talbots, but below the 350 and up of Ferrari and Alfa-Romeo.

With typical cunning, and always with a view to keeping down first cost, Archie used many Jeep chassis and transmission parts for the four-wheel-drive "S2", as the machine was designated. It earned the Butterworth *equipe* innumerable "Fastest Times of the Day" all over the British Isles. S2 might easily have been the reason for this story ending very abruptly, for in 1951 it crashed heavily at over 90 mph while competing in the famous Shelsley Walsh hill-climb. Archie was thrown out of the car and for a brief moment thought he was going to get away with it, but he plummeted down and broke eight ribs on S2's unyielding bodywork.

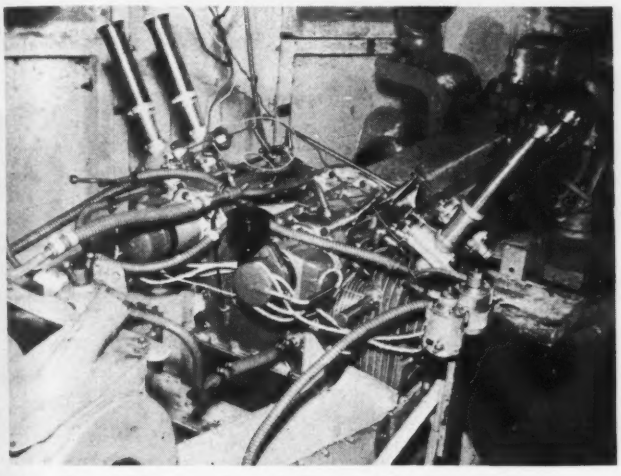
The Steyr engine had served its purpose. A lot of data had been collected and Archie was now certain that air-cooling was right for high efficiency power units. He had also learned that Steyr connecting-rods were not robust enough for such high outputs. At Weston-Super-Mare he had made fastest time of the day even after a rod had gone through the side of the crankcase 200 yards from the finish line!

To eliminate this frustrating and expensive weakness, better balanced, horizontally-opposed layout was chosen for the new four-cylinder new engine. Conventional poppet valves were used to get the engine basis right before experiments were started with the new swing-valve system. Although two of these engines were sold to private owners, in whose hands they went extremely fast on occasions, they were regarded by Archie as mobile test-beds for the ultimate swing-valve engine.

Briefly, the swing-valve system eliminates the conventional inlet valve and guide. The mixture is admitted by a valve with a poppet-type head attached to a "rocker", which is a form of bell-crank. This bell-crank is operated by a short ¼ ounce pushrod from a crankcase-mounted camshaft and swings the valve head wide open during the intake period. Gas is thus admitted to the combustion-chamber through a virtually unobstructed inlet port. The sys-



Combustion chamber of this one barrel test-rig has been opened up for visual scrutiny. Swing valve can be seen lifted off seat. Inlet is almost unrestricted.



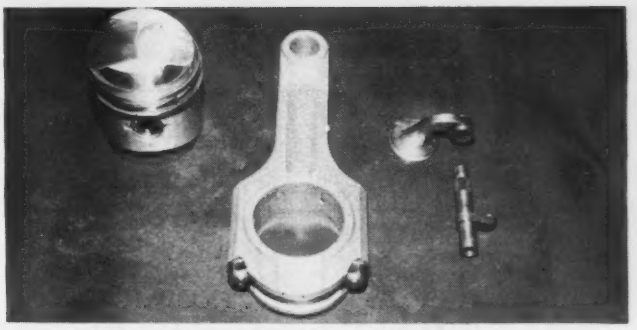
Smaller 1500 cc version of the new Butterworth engine incorporates the latest improvements including twin magneto ignition. Formula II chances are good.

tem is employed on the intake side only, as Archie feels that extraction of spent exhaust gases presents no problem, but that it's the filling of the combustion-chambers at high speeds that is the key to great power.

First of all, a 500 cc "single" was built (this being a quarter of the full-size two-litre four-cylinder engine), and running on alcohol fuel with a compression ratio of 12 to 1 it developed 47 bhp with reliability—nearly 100 bhp per litre. When it became known that the new I (This commenced on January 1, 1954) was to be for supercharged 750 cc units or for 2½ litre unblown engines, Archie turned to a larger size and increased the volume of the test single-cylinder engine to 600 cc. It wasn't long before that little power pack was turning out 55 bhp at 7500 rpm on a compression ratio of 13.7 to 1. Weight of this interesting mill is a mere 78 pounds.

During this period the valve springs suffered from surge at speeds over 6000 rpm, so Archie produced a set of small torsion bars which took the place of the conventional springs and eliminated the trouble. Another unusual feature of all the swing-valve engines is the absence of cotter pins. Archie's system is to tighten every nut, including big-ends, with a calibrated torsion wrench to a figure calculated from individual thread strains. The nuts have always stayed secure under the worst conditions.

The first 2½ litre swing-valve Formula I engine was assembled in 1954 and the long series of tests was begun. These still continue and are showing the utmost promise, but in order to be in early on the 1957 Formula II (un-



Left: *piston recessed to take two different valves.*
Center: *Con rod made of Rolls Royce light alloy.*
Right: *One-piece swing valve and rocker shaft.*

supercharged 1½ litre engines running on 100 octane fuel) Archie has produced a 1½ litre variant of the FI engine using many of the larger engine's components. This insured an almost unburstable design.

The 1½ litre unit is the same as the FI engine except for such details as bore and stroke dimensions. Twin magnetos and two spark plugs per cylinder are also fitted on the smaller engine. The twin mags will probably be included later in the specification of the larger unit.

The crankcase, which is split longitudinally, is of RR250, a Rolls-Royce alloy specially developed for gas-turbine application. This is the first time the alloy has been used for anything other than turbine use.

Attached to the robust crankcase are four horizontally-opposed, light-alloy air-cooled cylinders with heavily-finned cylinder-heads, also of RR250 alloy. Bore of the cylinders is 76 mm, while the stroke is 82½ mm (FI engine is 96 mm by 82½ mm). The massive crankshaft runs in three lead-indium bearings of the shell type, each with a diameter of 2½ inches. Big end bearings are of the same type and material but are 2 5/16 inches in diameter.

Archie obviously intends to avoid the connecting-rod breakages suffered with S2. The conrods on the swing-valve engines are unbreakable-looking, beautifully made and finished from another Rolls-Royce alloy, RR56. Wrist pin diameter is 15/16 of an inch.

Twin camshafts are mounted high up in the crankcase where they actuate short pushrods for each bank of cylinders. The swing intake valves are made of 100-ton air-hardening chrome molybdenum steel with 1 9/16 inch diameter heads. The conventional poppet exhaust valves are of KE 965 steel with sodium-filled stems.

The AJB power-units appear to have wet-sump lubrication, but actually, the dry-sump tank is positioned below the crankcase like a normal sump and holds two gallons of lubricant. Under test conditions with a small oil radiator, the oil temperature seldom goes above 70 degrees Centigrade.

First tests for the 1½ litre engine were made with a single-cylinder swing-value unit of 375 cc (quarter-size of the full four-cylinder unit) and this produced 32 bhp at 6100 rpm with reliability. Next step was to build a full-size unit and on its initial trials this produced 120 bhp at 5750 rpm. Compression ratio is 9.5 to 1 with 100 octane fuel. For an engine weighing only 225 pounds, these are exceptional figures, particularly when it is realized that no radiator or water will be needed on the car in which it will ultimately be installed. Even with these promising figures, Archie still feels that torque is the most important factor in current racing. It's hardly surprising, then, to find that the 1½ litre AJB has a peak torque of 116 lb-ft at 5000 rpm, and a brake mean effective pressure of 193 lbs. per square inch at the same revs. These again are exceptional figures for a small-capacity engine, and they should produce noteworthy performance in a modern lightweight sports/racing or Formula II car. #

SCI Technical Report:

The Fastest PORSCHE

By GRIFF BORGESON with KEN MILES & RICHIE GINTHER

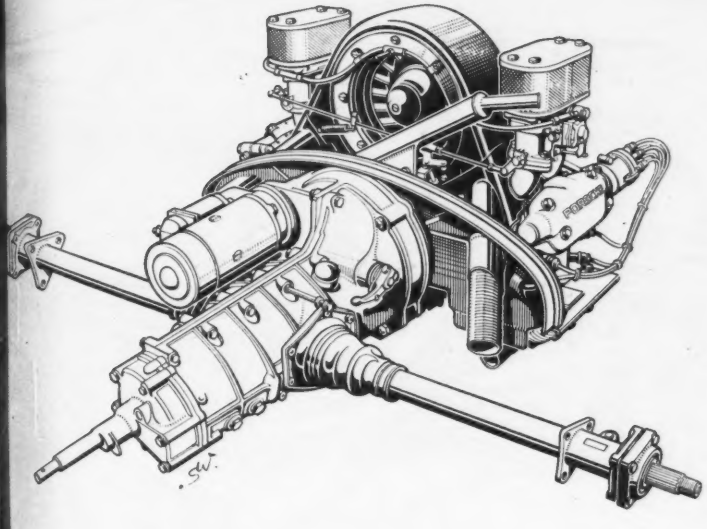
Photos by Don Typond

THE Porsche Spyder is a fantastic machine. It is fast and fiercely powerful, one of the most successful competition sports cars in history, and it has a personality no less complex than Dr. Jekyll's. At brisk highway speeds it is very easy to drive, docile, perfectly manageable, superbly responsive. It is even an easy car to drive "fairly" fast, the way Ken Miles and Richie Ginther have driven it in a long series of spectacular 1500-cc-modified wins. But to drive it really fast, as fast as it's able to go—this is work for a driving genius—for a man, as Miles puts it, "with extraordinarily quick reactions and an exceedingly delicate bottom." Says Miles: "I'm just not that much of a driver."

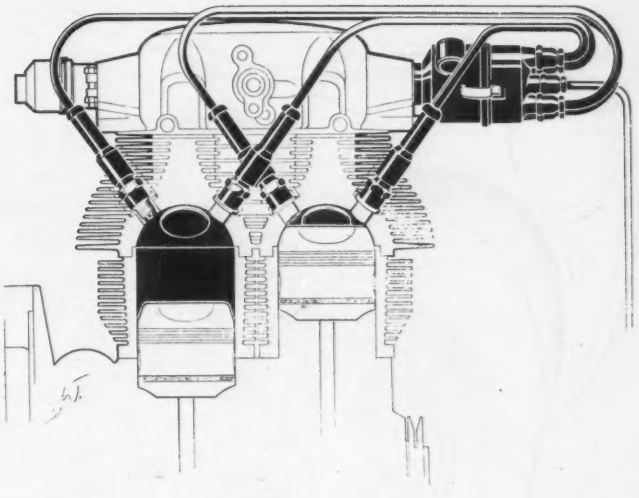
At the same time, there is nothing in the car's character that makes it inappropriate for use as a round-town hack. It has enough street equipment to satisfy the least austere sports car fan: top, windshield, trafficators, speedometer, windshield wipers, everything but R, H and OD, as they say in the used-car ads, and there's nothing to keep you from having radio and heater installed. Miles has a Spyder that he uses daily in L. A. traffic, and he says, "Why not? Set up for town driving, with soft plugs and the right jets, it's a joy to drive—comfortable, roomy, and it goes like a bullet from a gun when you open the tap."

I can vouch for part of his description—the last part. But SCI's test car, Richie Ginther's hurtling number 211, was hardly in street tune. The hard plugs were still in it from Palm Springs. The ¼ inch bored out intake ports and the whopping dual-throat Webers, mounted in place of the standard Solex carbs, reduced low-rpm fuel-air velocity to a near minimum. In the interest of better weight distribution, Ginther had gutted the cockpit and moved the spare tire and wheel in from their normal position aft of the engine. Sharing the passenger side with these impedimenta made the word "roomy" no longer accurate. With the big red numbers on the side, Ginther's Spyder didn't even *look* like a street machine. And there was, of course, the exhaust.

Richie Ginther bends the Spyder through some tight turns on the test course used by SCI.



Spyder engine coupled to transmission and final drive unit. Dual throat Webers used on Ginther's car are optional in place of Solexes.



Ignition layout. Two spark plugs fired simultaneously eliminate chances of misfire and ignite fuel from both ends of chamber.

In stock form the Spyder is fitted with expansion chambers in the forked exhaust pipes and a perforated can in the single tailpipe, and it's a reasonably quiet machine. But with a set of large diameter, straight-through pipes the sound is shattering. A single 4000-rpm blip on the throttle and you expect to see cracks spreading in nearby concrete walls. The exhaust note starts as a resonant, thundering hammer and builds to that indescribable ripping-canvas scream that can come only from a barrel chested 7500 rpm.

It was in this inconspicuous fashion that Ginther and I took off through Hollywood in heavy morning traffic, in an aura of fragrant Castrol fumes. To reach the coast in order to bear north we had to pass through Beverly Hills, a town that takes pride in the strict enforcement of its anti-noise laws. It's a handsome tribute to car and driver that we ran the gauntlet without accident. The Spyder engine stroked along docilely at 1500 rpm in top gear! In spite of its steep power and torque curves it felt enormously strong at low revs, strong enough to make other 1500 cc road machines seem feeble by comparison.

Once we hit the back country, though, we could give the beast its head. The first maneuver was to take it through the first three cogs up to 7500 rpm, to clean out the residues of an hour's poking through traffic. The savage, lunging character of the car under full throttle is unforgettable. Up to about 5000 rpm it feels like one of the thrustiest machines you've ever driven, but then the cams hit their stride and the power *really* comes on. The most useful power range is concentrated in a narrow band between about 6000 and 7000 rpm.

"It's hard," said Ginther, "for a guy getting out of a pushrod Porsche to learn to keep the revs up. In a normal Porsche you get up to 5500 and the valves bounce. A pushrod man in a Spyder invariably feels that he's starting to wind the engine pretty tight long before he gets there. This car is geared for about 125 mph at 7500, and I turn to

TEST CONDITIONS:

Number aboard	Driver only (during speed runs).
Top position	Removed
Temperature	86°F.

TOP SPEED:

Two-way average	128.3
Fastest one-way run	129.6

ACCELERATION:

From zero to	Seconds
30 mph	3.4
40 mph	4.6
50 mph	5.2
60 mph	7.2
70 mph	9.5
80 mph	13.2
90 mph	15.0
100 mph	19.5

PULLING POWER: (Tapley Meter)

	Lbs/Ton	Grade %	Mph
I	off scale	..	..
II	600	31	41
III	460	24	58
IV	250	13	75

Drag at 10 mph	10
Drag at 60 mph	55

SPEEDOMETER CORRECTION:

Indicated	Actual
30	28.8
40	36.5
50	45.0
60	53.2
70	61.6
80	70.3
90	78.2
100	87.0

FUEL CONSUMPTION:

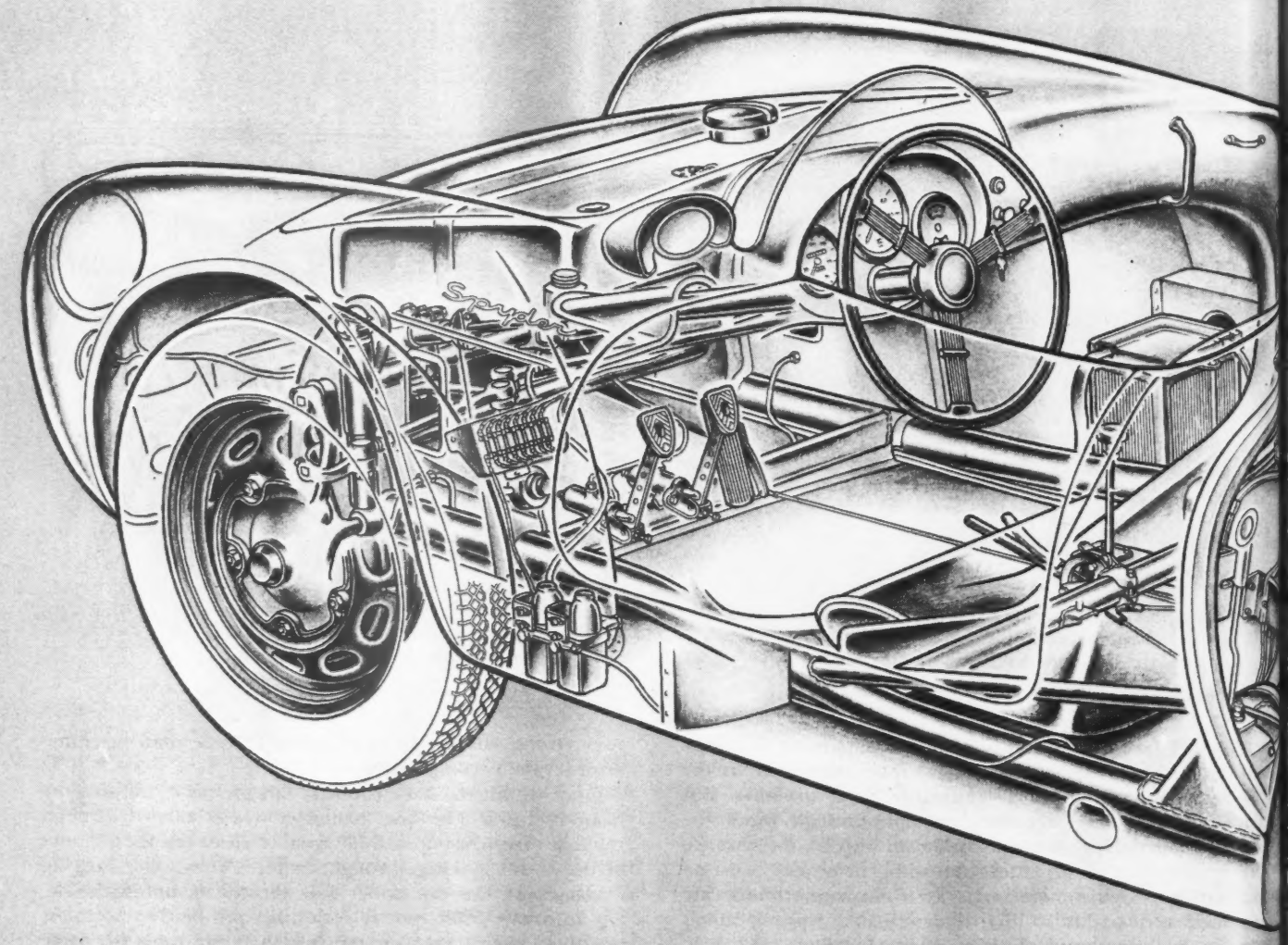
Hard driving ..... 18.5 mpg during entire test.

BRAKING EFFICIENCY: Summation — zero fade.

SPECIFICATIONS

POWER UNIT:

Type	Four-cylinder opposed, air-cooled.
Valve Arrangement	Vee-inclined valves, d.o.h.c.
Bore & Stroke (Engl. & Met.)	3.35 x 2.60 ins; 85 x 66 mm.



PORSCHE SPYDER "...like a bullet when you open the tap."

Stroke/Bore Ratio .....0.78 to one.
Displacement (Engl. & Met.).....91.4 cu. ins; 1498 cc.
Compression Ratio .....12.0 to one.
Carburetion by .....Two dual-throat Webers.
Max. bhp @ rpm .....130 @ 7000 (approx.).
Idle Speed .....1500 rpm.

CHASSIS:

Wheelbase .....82.7 ins.
Front Tread .....51.4 ins.
Rear Tread .....50.0 ins.
Suspension, front .....Transverse torsion bars (laminated), fully adjustable.
Suspension, rear .....Transverse torsion bars (solid), fully adjustable.
Shock absorbers .....Telescopic double acting; one per wheel.
Steering type .....ZF-Gemmer Worm and Ball.
Brake type .....ATE hydraulic; two leading shoes front.
Brake lining area .....165 sq. ins.
Tire size .....F500 x 16; R525 x 16.

GENERAL:

Length .....141.75 ins.
Width .....61.0 ins.
Height .....40.0 ins.

Weight, test car .....1480 lbs. (full fuel tank).
Weight distribution, F/R 48.6/51.4
Weight distribution, F/R, with driver 49.1/50.9
Fuel capacity .....17.2 U.S. gallons.

RATING FACTORS:

Bhp per cu. in. 1.42
Bhp per sq. in. piston area 3.69
Pounds per bhp, test car 11.4
Piston speed @ 60 mph .....1564 fpm.
Piston speed @ max bhp .....3033 fpm.
Brake lining area per ton, test car .....223 sq. ins.

TRANSMISSION DATA

Gear	Trans. Ratio	Tooth Comb.	Overall Ratio	Mph per 1000 Rpm	Mph @ Max bhp	Max Test Speed	Equals Rpm	Equals Ft./Min.
I	2.54	13/33	12.34	6.3	44	47	7500	3250
II	1.76	17/30	8.55	9.1	64	68	7500	3250
III	1.23	22/27	5.98	13.0	91	97	7500	3250
IV	0.96	25/24	4.67	16.6	116	129.6	7800	3380

Final drive ratio, test car 4.86; 7/34
Other available final drive ratio...4.43; 7/31
Axle torque taken by .....Radius arms.

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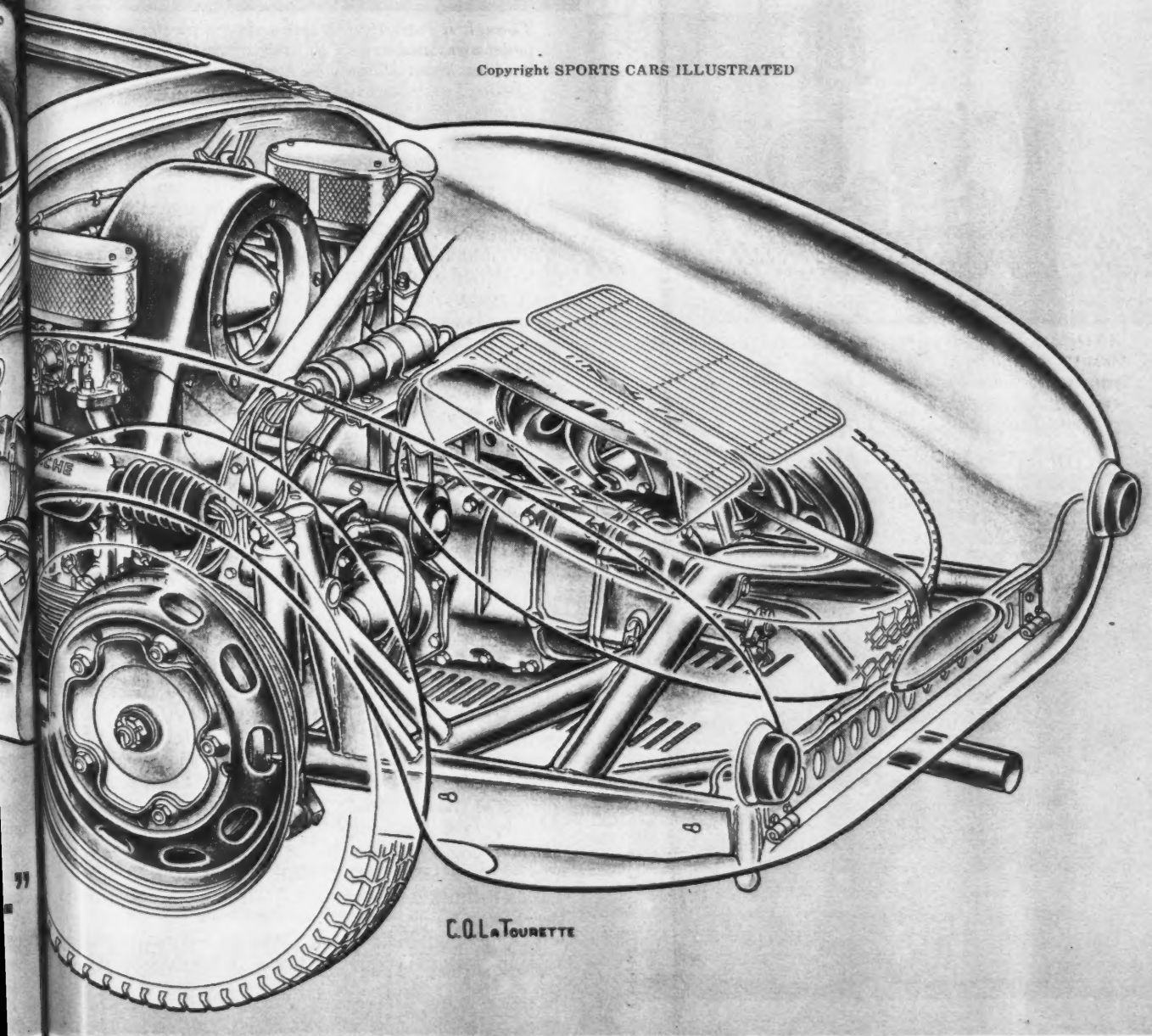
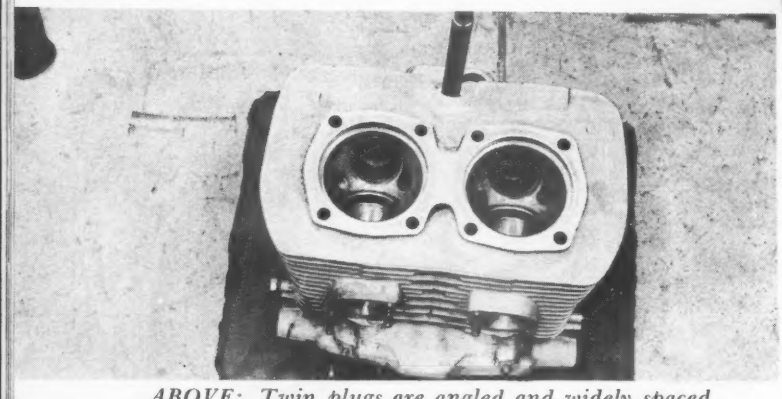


Richie Ginther gives Stu Hilborn the lowdown on the big downdraft Webers. Stressed sheet housings over rear shocks supplement original big-tube supports.

Though it's strictly for go, as shown by the drilled pedal arms and exposed frame tubes, the Spyder has a road-car finish This one has directional signals!



ABOVE: Twin plugs are angled and widely spaced, ensure complete combustion. They're placed near valves and seats, to minimize local hot-spotting. Ports are big, but more important, their sectional area is constant throughout. Shaft drive to cams can be seen at top.

BELOW: Deep bevels in healthy piston crowns provide clearance for misbehaving valves. Cylinder finning is symmetrical as possible to prevent uneven expansion of bore. Pump and connections for dry-sump oil system are at lower right. Cam drive leaves sump at center.

7800 regularly. At Palm Springs I tried to keep it above 5500 coming out of all the corners. There's a 4200 ft. straight-away on the course, and if I came out onto it clean and fast at about 80, I turned a good 8000 rpm before I had to shut off. We know we can turn 8200 without valve gear trouble, and even at this figure piston speed is no problem."

Learning to drive by the tach and ignore the scream of the d.o. engine may be tough, but it's childishly simple compared with taking the car around a race course at something approaching its limits of adhesion.

"The Spyder," Miles says, "isn't like, say, a Maserati 1500—a car that anyone can get into and drive right on the ragged edge. With an ordinary car, when you're cornering fast there's a point where the car is perfectly stable, a point where the car is gone, and a substantial transition point, where you know it's starting to go and can do something about it. With the Spyder it happens *now*. A fairly good driver has no trouble taking it up to the point where it's nearly gone—but the brilliant driver, the genius, can add 5 mph to the cornering speed beyond that point. I'm referring here to a Kling or a Moss, not to myself."

You'd never, of course, discover limits on the road. At speed you can't even detect that the Spyder has a swing axle. It rides dead-flat and stays glued during terribly fast cornering. In a 30 mile ride over twisting mountain roads in Ginther's car, I noticed no sign of that usual "Porsche characteristic"—the slippery rear end. There's a lot less change of track in the Spyder than in the ordinary Porsche. Its very considerable negative camber brings the pivot point of the swing axle closer to the road. A line drawn through the point of tire contact with the road is more nearly parallel with the road, so that the contact points move more nearly straight up and down.

You do notice the swing axle on a fast corner with an uneven surface, where you get great side forces combined

Ken Miles feels the Spyder is a fine street machine, and is setting out to prove it. Single screen, twin rear view mirrors and fast-open oil cap reveal reality.

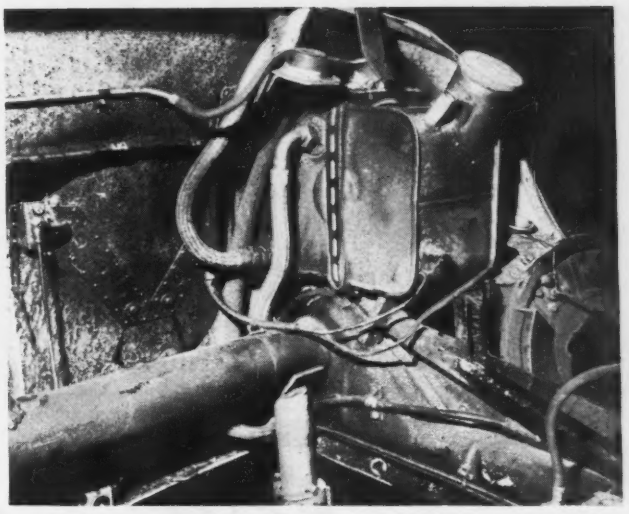
with a lot of wheel movement. This, added to the fact that the front suspension flexes a lot under these circumstances, makes the car a hell of a handful on a fast, bumpy course. The unsprung weight in the rear is fairly high relative to the weight of the car; it includes the big axle tubes, brake drums and radius arms. Among the effects of all the weight is a good deal of rear wheel patter when you're braking hard on rough surfaces. A lot of this has been eliminated in the new space-frame Spyder. The frame is a much stiffer structure, which helps the front suspension, and the rear suspension *always* has negative camber.

Of the Spyder's handling qualities Ginther has this to say: "The fastest way around a slow hairpin turn is a matter of driver opinion. But on any fast turn the straightest, smoothest line is the fastest way. You can put a man in it who can dirt-track all over the course, but a straight-line man like Miles will drive right by him and not even look fast.

"If the Spyder's tail comes loose you can just leave it hanging out. You won't go as fast as when it's behind you, and I know that for sure. But you'll get into no trouble, and you can ignore it—which you'd better not do in the 1600 Speedster. Once the front *and* rear wheels start sliding, though, you're in a different situation. You have to anticipate how much room you have left, how much of it you're going to use, and manipulate throttle and steering accordingly."

The Spyder's steering is as light as they come. The brake pedal and clutch pedal pressure are light—very light. Throttle response is good, particularly when you approach the engine's peak-power operating range. There's nothing to changing gears; you shift with a true flick of the wrist. All the pedals are wide-spaced, and there's no doubt about which foot is on what. The ride is soft. There is no high-

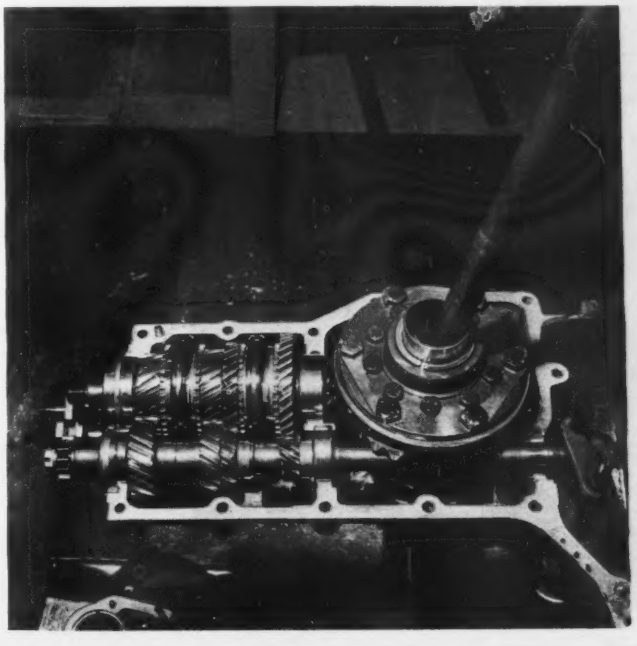
(Continued on page 60)



Oil tank is fitted with filler, vent, temperature pickup and connections to engine and front-mounted radiator. It's held by a felt-lined steel strap.

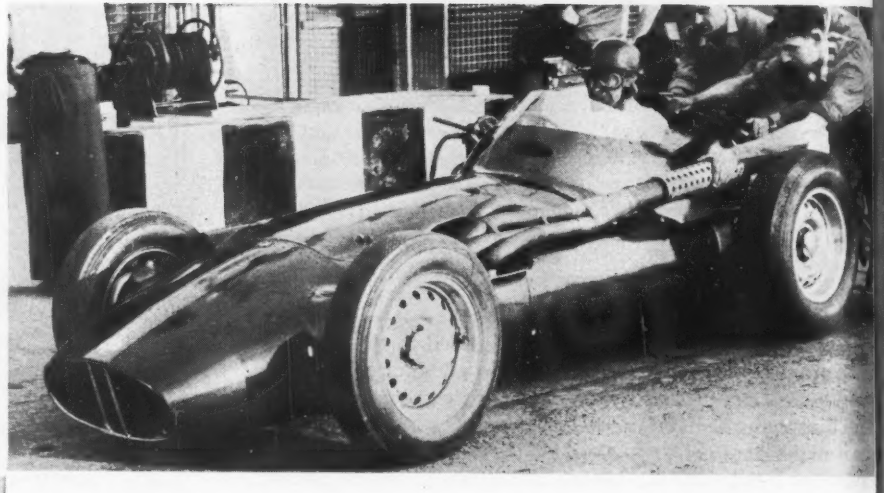
Valve fingers pivot on spherical surfaces, are retained on vertical rod by small spring and bracket at right. Valves, springs, shims, retainer and cotters, and cam are here.

Still housed in the Volkswagen case, the Spyder gearbox offers a wide ratio choice and wrapping-ring synchro. A ZF differential is fitted here, has been no trouble.

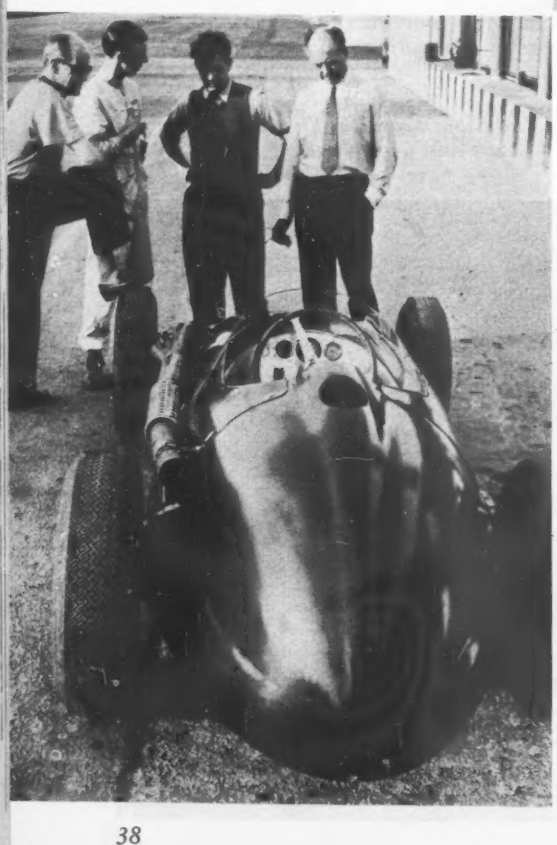


BRM

Ten Lap Terror



RIGHT: *Mechanics push latest BRM away from Monza pit, with Tony Brooks at the wheel. Deep cockpit cowling is major exterior change.*
BELOW: *At fall Monza tests, (L to R) designer Berthon, driver Brooks, a mechanic and promoter Mays scrutinize the BRM. A transverse leaf has replaced the Lockheed air-oil struts at the rear.*



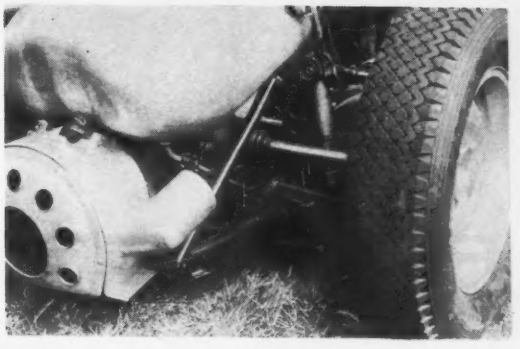
OVER SEVEN years ago the powerful British motoring press was shouting to the world that the British Racing Motors Grand Prix car was to be the ultimate in G. P. design. They published all sorts of graphs proving on paper that the 1½ litre supercharged V-16 would whip any existing machine, and that the V-16 design was far superior to German and Italian engine layouts.

This display of enthusiasm was not without good reason; the "old" BRM was indeed a fine machine — on paper. Even the usually unexcitable Griff Borgeson, writing about the BRM shortly after it was released to the Press said, "By 1951 it should either blow up or be supreme." If the builders of the car had been backed as intelligently as in European competition, the entire history of post-war G. P. racing might well have been painted in British green instead of Italian red.

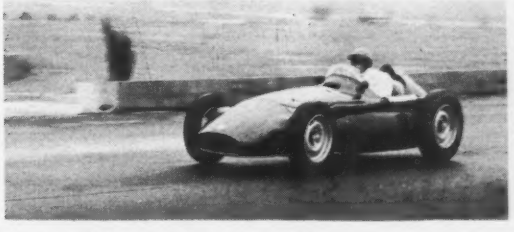
The conception of an all-British Grand Prix car was a dream concocted by Raymond Mays, who began his championship career during the '20s in racing and hill climbing events. Mays, and a very able engineer named Peter Berthon, designed and produced the successful pre-war ERA racing machines. Together they began technical development of the BRM in 1939, designing a pilot model which was constructed by Automobile Development, Ltd.

During the past season the BRM was known as the fastest accelerating GP car in the business—for the first 10 laps. New goal: the full Grand Prix distance.

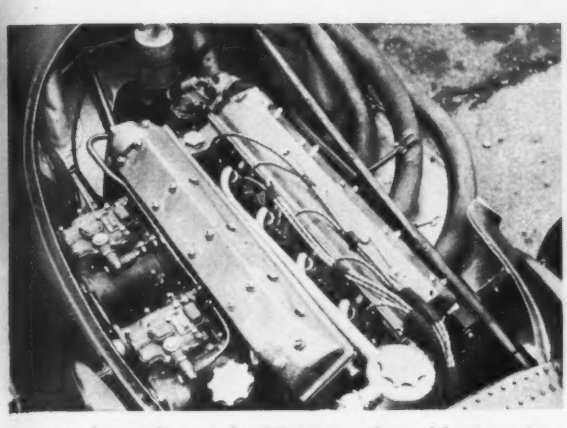
By BOB ROLOFSON



Air-strut springing was used on early cars. Fuel tank was rubber-mounted at three points, and air ducted to single rear disc.



Peter Collins tried early version at Silverstone, wasn't happy with handling.



Early version of the BRM four-barrel had modest exhaust manifolding. Big-bore Webers and twin ignition were fitted. Detail finish is very good.

Latest twisted tuned exhausts are BRM trademark. As before, they're bolted to frame and telescope-jointed at ports. Four has been shifted forward slightly.

a non-profit organization with headquarters at Bourne.

In February of 1947, the British Motor Racing Research Trust was formed for the purpose of financing and controlling the venture. Some 160 automotive component companies were subscribers to the Trust, some part of which was contributed in cash, and some in gifts of materials and labor. The Trust Committee was made up of representatives from the largest companies supporting the venture.

The aim of the organization was presented as follows: *"To construct a team of three 1500 cc racing cars embodying the latest developments in engine, chassis accessory design. To race the team of cars in Britain and abroad at all times in such a way as to promote national prestige and to demonstrate the quality of British engineering as a whole. To co-operate technically with manufacturers and to conduct all forms of tests, research and developments in the wide field available. To enable experiment and research, hitherto conducted principally in the laboratory, to be carried into the field of practice. To completing all the data essential to the furtherance of general research."*

The Trust had a total of £150,000 ($420,000) in cash and material, but no regular income, and at times it was doubtful if they could pay their weekly payroll. While this might be considered quite a pile of gold, it dwindles to nothing when you consider that a good part of the cash had to be invested in buildings, equipment, supplies and payrolls.

The final stage in their search for funds was the formation of the British Motor Racing Association, which asked support of the motoring public in general, offering membership (£1) and associate membership (5s) with badges. This appeal to the public was based on the fact that the BRM, if successful, would be a vital weapon for British propaganda, linked inseparably with the country's export program.

This appeal, plus the fact that the British are rabid auto racing fans, brought the development of the car to the attention of the national press, which in turn pressured the builder into releasing the BRM before it was ready. Adding to this pressure was rumor of strife in the Trust, with secret deals being made to exploit the lack of funds, and to bring the project under the control of one of the more powerful contributing companies.

Victim of freak press promotion, improperly organized finances, and too many masters, the Trust died a sudden death in October, 1952. The assets of BRM (for which six bids were made) were purchased by Rubery Owen & Company, Ltd., well-known manufacturers of automotive com-

(Continued on page 62)

SCI

ROAD TEST:

The Austin Healey 100-6

SCI's Tech Editor wheels Healey into a 45 mph test right-angle corner. Front and rear suspensions are equally depressed, and exhaust system is nearing road surface. Ribbed tonneau cover stays flat in any wind.

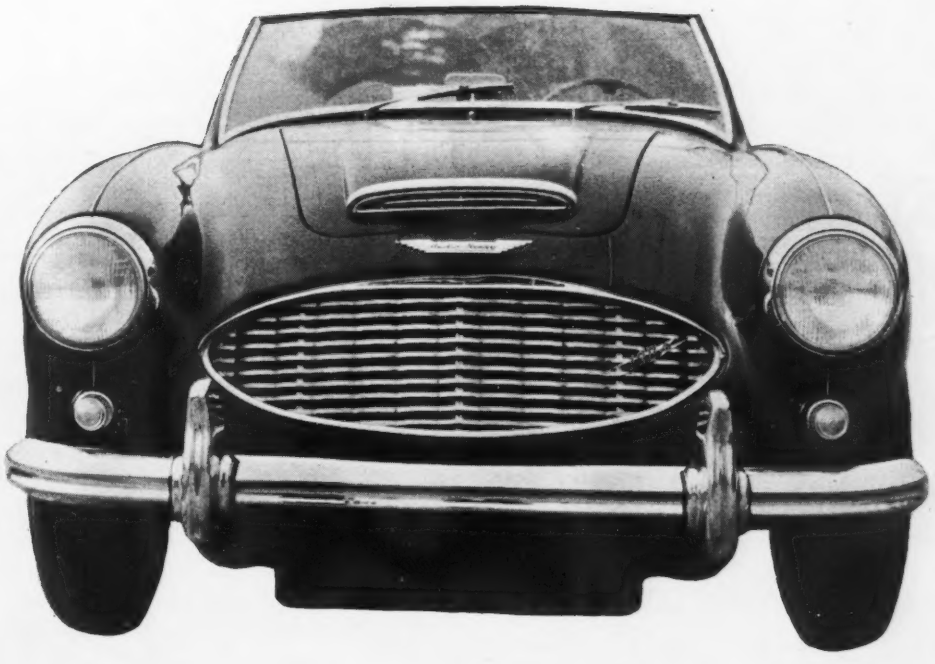
OUR prized salt flats are now being besieged annually by Donald Healey and a crew of trained men and tuned machines. In 1956, Healey realized his ambition of 200 miles per hour with a blown Bonneville-style streamliner, and as an added attraction he brought along a handsome Monza-nosed version of the standard 100 roadster. Big news was under the hoods of both cars, in the shape of the BMC six-cylinder C-Type engine. This had been around for over a year, and was long overdue to replace the outdated four-banger that was an inheritance from the ill-fated A90 Atlantic Austin.

The production version of this prototype includes the new engine and a host of other refinements, but doesn't have the rakish snout of the record-breaker. We hope they can make this a practical proposition for future editions. As it stands, the Austin-Healey 100-6 for 1957 has acquired a more forceful air as a result of some heavy face-lifting, and the front end and convertible top have a wholly new character.

Technically, BMC has taken this opportunity to update many details and include advances in braking and heating made by their suppliers, Girling and Smiths. These are welcome, as is the revision in space allotment at the rear of the car, but that smooth new six makes it feel like an entirely different car. There's a *smooth* steam-engine surge in any and all gears, even in overdrive top, the instant the tap is opened. The six has three pound-feet less torque and a dozen more horses at the top end, while weight is up by about 200 pounds. As might be expected, the four has more punch below sixty, but is way behind the six from seventy up.

Results are roughly the same, but the new car *feels* much hotter all through the acceleration range. This is no doubt due in part to the smoothness of the six, which digs in with a solid pull instead of a series of bangs. It has no flat spots or awkward moments, and is vibration-free up to and past the 4800 rpm redline. Our test car, supplied by Hambro Automotive Corporation, couldn't be considered fully broken-in so there's probably still more in store under the hood. As a cruising hill-climber it was excellent, and felt like a lot more than 160 inches. One particular hill in SCI's test area has a gradient of over 15 percent, and the 100-6 needed only a shade over half throttle to amble up the slope at a steady 40 mph in direct fourth gear.

In more menial ways it satisfies too, and it starts at once from very cold if the under-dash choke is pulled out to its



Front end has been face-lifted to fit longer engine and provide "new look". Hood scoop admits additional air to radiator.

Photographs by Don Typond

Rear seats are clever, hold kids firmly and comfortably. Improved interior detailing includes dash heater control and cowl padding.

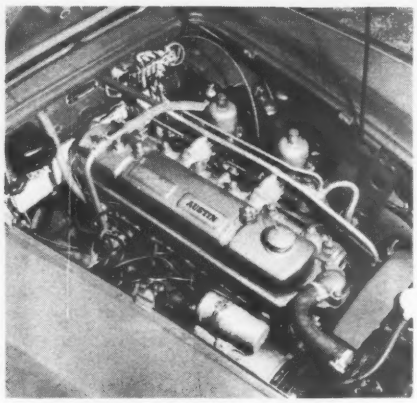
Top is completely new in design and fastening. It's weathertight and drum-free. Also new are gas cap, door handles and windows.

Battery and spare have moved into trunk; and lid size is smaller. Capacity is still good, and is supplemented by back seat space.

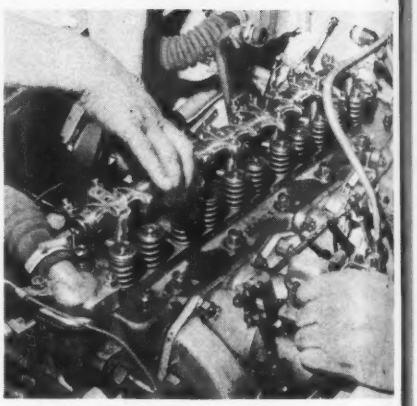
second position. When the 175 degree running temperature is reached it idles steadily and unobtrusively. This temperature was exceeded only during the rugged acceleration-braking test, and then only by 20 degrees. Unlike most of the Healey four-bangers, the engine could always be turned off with the ignition key instead of the clutch.

The six responds well when the throttle is tromped, though a fault in the linkage of our test car produced about an inch of initial motion during which nothing happened. Dealers should keep an eye on the linkage supports and pivots. Under full bore the twin dry air cleaners can be heard sucking away, and the exhaust note is a muffled hum. As the revs sweep up by 3500 rpm it rounds out into a musical drone; overall it's like a standard Jag in sound and feel. It's a big step forward from the goatish blat of the old 100. Seekers after the truth will probably carry the split exhaust all the way back, instead of joining the big pipes in the muffler. Ground clearance is still a problem, by the way, and the front end of the muffler seems to be the lowest point.

Length of the new engine shoved the radiator core ahead of instead of behind the front crossmember, and the size of the hood opening has also been increased a welcome amount. The hood hinges from the rear instead of the front, double safety catches ensuring that it'll stay put. Accessibility is vastly improved. The plugs, coil, distributor, generator, carb adjustments and twin hydraulic fluid reservoirs are easy to reach. Emergency work on the SU's, as well as mixture density, is enhanced by a heat-reflecting shield between the



ABOVE: Fast and hard through right angle, 100-6 is stable and controllable. Roll is visible but does not disturb driver. LEFT: Big C-Series six is neatly installed, fully accessible. Stock intake manifold is integral with head, will take bigger SU's. RIGHT: New head, valve gear, special intake and exhaust systems add fire to Bonneville Healey prototype. Next year???



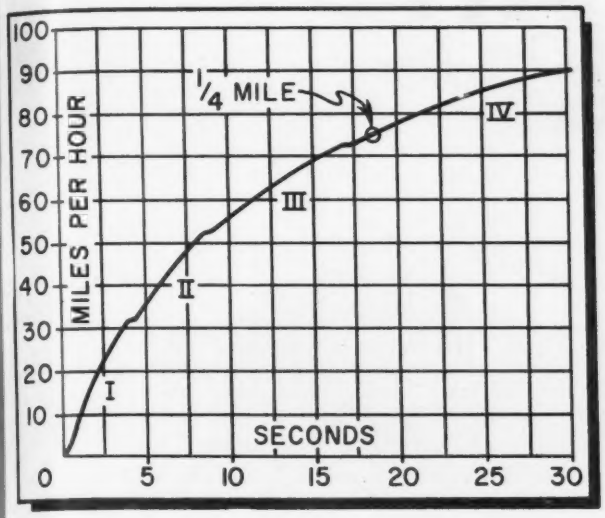
exhaust manifolds and the carb float bowls.

Hanging-type foot pedals are made possible by hydraulic clutch actuation, and the clutch itself was fine under all conditions. It bit hard and clean on the takeoff and during fast shifts, but was gentle when puttering and easy to disengage.

The C-type BMC gearbox is unchanged from last year, and retains its rugged, unbreakable feel. Shift pattern is standard for four-speed boxes, with reverse a healthy tug to the left and back. Lever motion is solid, guided by a sharply-defined gate, and the synchro on the top three speeds can't be beaten but needs to be pushed strongly into mesh. The motion from second to third is awkward, and some of the slowness on this car seemed to stem from a reluctance to come *out* of gear. Shifts will go through just as fast as you're able to throw them.

Overdrive, as before, can be used in the two top gears only, and third OD is again a virtual duplication of direct fourth. Operation of the familiar Laycock unit is positive and easy, the dash switch being in ready reach. Downshifts can be preselected and then engaged by a poke at the throttle. Gearing is such that the engine overrevs at top speed in direct fourth and can't reach peak in overdrive, which gives the 100-6 a lot of top gear pep and easy cruising at 85-90 mph in OD.

The gearbox ratios are themselves well spaced, but first is needed only for traffic crawling, second-gear starts being a cinch for the mild-minded. If you have an urge to be the first to knock down the pedestrians, you can flick the clutch home while the tach wavers around 3500. The tail squats (not bottoming like the '56), the tires growl briefly and you pump through shifts at thirty, fifty and seventy accompanied by a soaring moan of power and a satisfying slug in the shoulder blades. Second gear is a real heart-warmer.



and you can handle almost any situation in third.

Another major sales point for '57 is the new top and seat arrangement, intended to broaden the market for Healeys by catering to the kids. As a result of the clever junior buckets, the new A-H is unsurpassed for family use in the true sports car class, though a few others are very nearly as good. One of SCI's staff used the car for a normal suburban weekend, with top up and wife and progeny aboard. All the usual chores of Saturday shopping and Sunday visiting were accomplished with as much ease and as little cramping as would occur with an ordinary hack convertible. For a one-car family with a long-time yearning for a sports car, the 100-6 comes close to being the answer, particularly when price is taken into account.

If you've owned an older Healey, and feel that you wouldn't want to take the kids anyway since they might catch pneumonia, you can relax with the new version. The front edge of the top interlocks with the head of the fixed windshield, giving a foolproof seal. After this is hooked, the fourteen snap fasteners around the rear are popped home. The handsome aluminum-framed side curtains mate with grooves in the windshield posts (which prevent rattling) and with flaps in the top (which keep out the weather). One flaw is the tendency of the sides of the top to lift at 70 mph and above, admitting rain above the curtains. The sliding panes in the curtains are handy vents, but their shallow knobs are fingernail-busters.

Two people can put the top up and down easily, and it folds into a compact trough behind the "rear seat". The side curtains slip into an envelope for storage. The heating system is now much better built in than before, and fills the cockpit with warmth in winter weather. Defrosting is potent, while fresh-air ducts from the front are provided.

To cope with the longer open space when the top's down, a specially stiffened tonneau cover and supporting bow

(Continued on page 64)

AUSTIN-HEALEY 100-6
PERFORMANCE

TOP SPEED:	4th	4th OD
Two-way average	98.9	104.2
Fastest one-way run	100.0	108.4

ACCELERATION:

From zero to	seconds
30 mph	3.8
40 mph	6.1
50 mph	8.3
60 mph	11.6
70 mph	15.7
80 mph	21.3
90 mph	30.4
Standing ¼ mile	18.2
Speed at end of quarter	75 mph

SPEED RANGE IN GEARS:

I	zero to 30 mph.
II	2 to 50 mph.
III	6 to 72 mph.
III OD	14 to 94 mph.
IV	15 to top.
IV OD	20 to top.

SPEEDOMETER CORRECTION:

Indicated	Actual
30	31
40	39
50	49
60	59
70	69
80	79
90	88
100	97

FUEL CONSUMPTION:

Hard driving	19 mpg
Average driving (under 60 mph)	27 mpg

BRAKING EFFICIENCY:

(10 successive emergency stops from 60 mph, just short of locking wheels):

1st stop	.70
2nd stop	.70
3rd stop	.70
4th stop	.70
5th stop	.67
6th stop	.65
7th stop	.63
8th stop	.64
9th stop	.65
10th stop	.63

SPECIFICATIONS

POWER UNIT:

Type	In-line six.
Valve arrangement	Vertical in-line, pushrod.
Bore & Stroke (Engl. & Met.)	3.13 x 3.51 ins; 79.4 x 89.0 mm.
Stroke/Bore Ratio	1.13/1
Displacement (Engl. & Met.)	161 cu. ins; 2639 cc.
Compression Ratio	8.25/1
Carburetion by	Two SU sidedraft H4.
Max. bhp @ rpm	102 @ 4600
Max. Torque, lb.-ft. at rpm	141 @ 2400
Idle Speed	750 rpm.

DRIVE TRAIN:

Transmission ratios I	3.08
Rev.	4.17
II	1.91
III	1.33
IV	1
Final drive ratio (test car)	4.1 (with 0.78 overdrive).
Other available final drive ratio	3.91
Axle torque taken by	Rear leaf springs.

CHASSIS:

Wheelbase	92 ins.
Front Tread	48¾ ins.
Rear Tread	50 ins.
Suspension, front	Wishbones and coils.
Suspension, rear	Semi-elliptic, Panhard rod location.
Shock absorbers	Lever-type hydraulic.
Steering type	Cam and peg.
Steering wheel turns L to L	3
Turning diameter	35 ft.
Brake type	Girling hydraulic, 2LS front.
Brake lining area	188 sq. ins.
Wheel studs, circle diameter	Splined hubs.
Tire size	5.90 x 15.
Rim type	4J

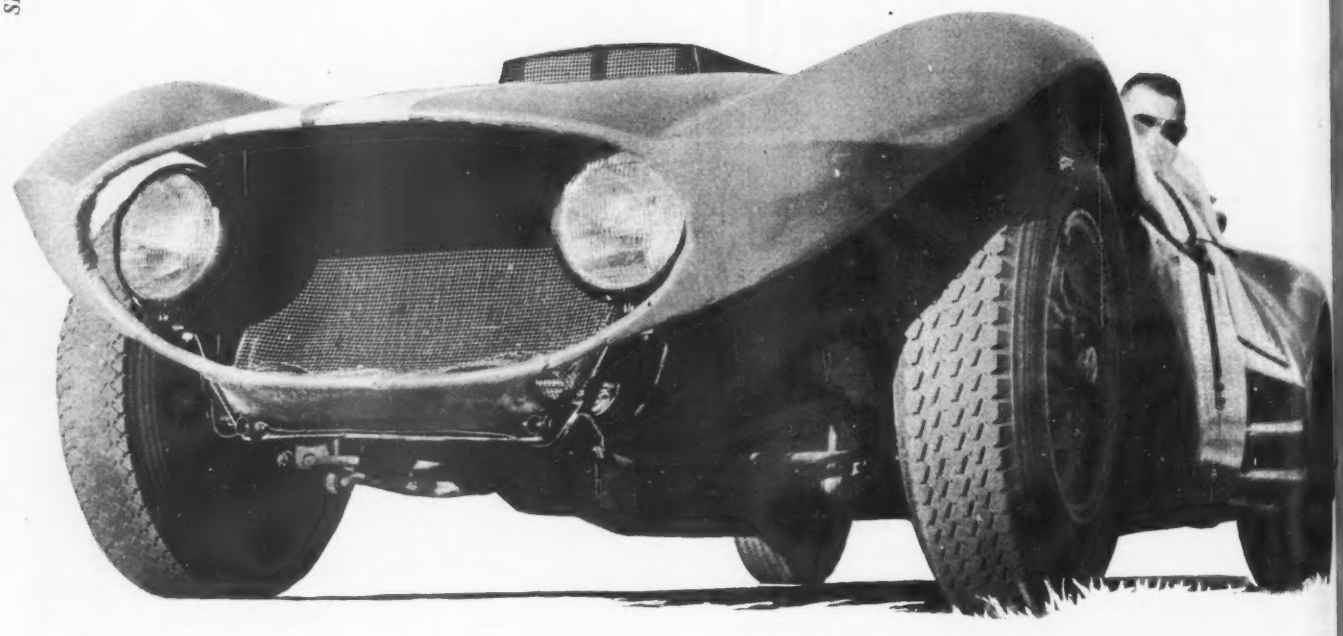
GENERAL:

Length	157½ ins.
Width	60½ ins.
Height	49 ins. (top up).
Weight, test car	2440 lbs.
Weight distribution, F/R	48/52
Weight distribution, F/R, with driver	48/52
Fuel capacity	14½ U.S. gallons.

RATING FACTORS:

Bhp per cu. in.	0.634
Bhp per sq. in. piston area	2.21
Torque (lb-ft) per cu. in.	0.875
Pounds per bhp (test car)	23.9
Piston speed @ 60 mph	1500 fpm.
Piston speed @ max bhp	2680 fpm.
Brake lining area per ton (test car)	154 sq. ins.

BACKYARD D-TYPE



Jack Baird peers over the sloping flank of his formidable Class C Special. The twin exhausts are recessed in the left-hand side and emerge, C-Type fashion, ahead of the rear wheel. He hammered the aluminum himself.

By ERIC NIELSSEN

Whether you build your D-type or buy it, the DOHC Jaguar six is ready for the man who wants to squeeze out some extra power.

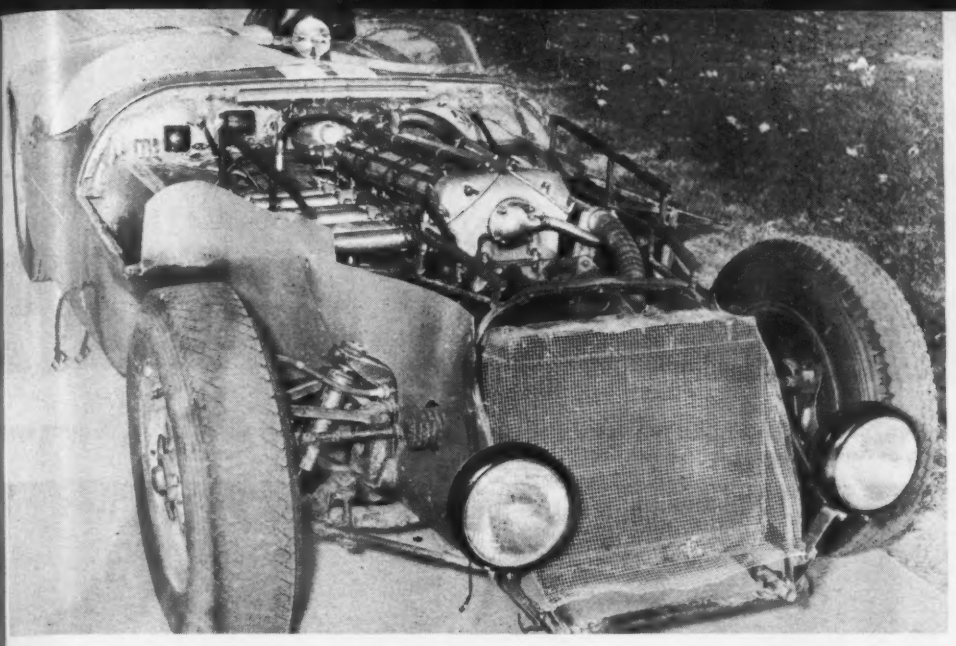
FOR years the hop-up boys have been moaning that they can't get a decent twin overhead cam engine in a man-sized displacement class, and they say they're fed up with pushrods and rockers. The answer to their prayers has been a'building since late '48, but only these days are they getting down to backyard-level prices.

The Jaguar Six has always been hailed as a miracle of modern production methods, and indeed it brings pure racing features to the mass distribution level on a scale as yet only dreamed of by other manufacturers. Yes, they cut corners here and there to do it, but the basic design still offers more scope for souping than anything we'll ever see over here.

Since SCI's D-Type tech report (May, 1956), and the rundown on the fascinating 2.4 liter Jaguar engine (November, 1956), we've been inundated with requests for dope on extracting the ultimate from the big 210-inch long-stroke XK-120 series engine. As we receive the good word we'll print it, and we hope more of these engines fall into the hands of Those Who Know.

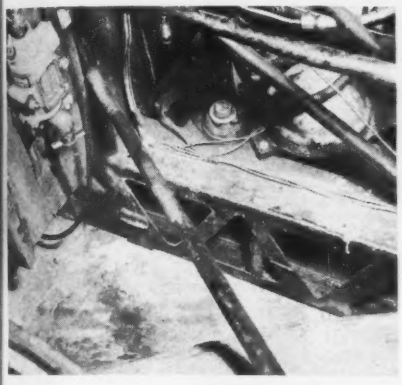
Though we mention only the 120 engine above, many builders have gone the route with the whole car, and the machine growling at you from these pages is one of the cleverest yet cheapest we've seen. Resurrected from the wreck of an XK-140 MC roadster, the Baird-Jag Special has become the scourge of Class C Modified in the Southwest. It's the handiwork of Major Jack Baird of the USAF, and Jay Joyce, both of Albuquerque, and it was reported to us by Gordon Chittenden.

The builders specifically wanted a rapid, rugged machine for the Carrera Panamericana, and driver safety has always been high on their list. After heating and straightening, the frame was very neatly lightened by cutting out triangles to form a truss-like structure. This didn't impair torsional rigidity or impact strength. All body hangers were cut off, and the center crossmember was notched to lower the trans-

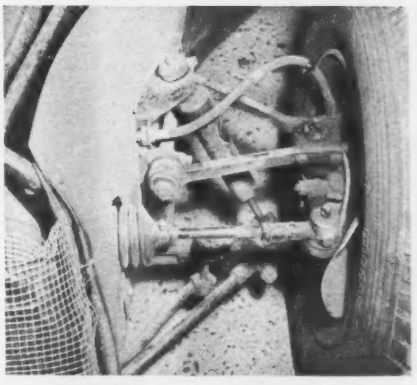


Front end lifts off for easy access. Tubing supports body and radiator, latter is protected by heavy mesh. Basic suspension, chassis remain stock Jaguar.

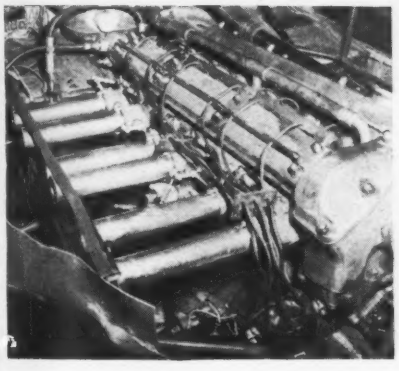
Photos by Chittenden



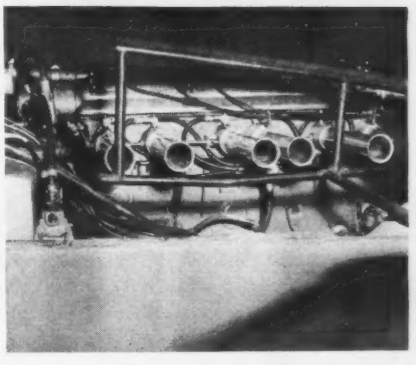
Method of lightening stock frame is clever, correct in theory. Triangles were cut out to form truss-like structure. Fuel filter for injection on firewall at left.



Outer end of MG rack-and-pinion tie rod is welded to Jaguar ball fitting. Scoop has been added to vented backing plate. Columbus 50/50 shock stiffens suspension.



Hilborn injection proved better than triple Carters or Webers for home-built D. Injection pump is driven from rear of intake cam, mounts on machined adaptor.



New manifold draws hot water from center of cylinder head, feeds rear-mounted header tank. Eight-inch ram tubes are injection musts. Ignition is Magspark.

mission mount two inches. The front motor mounts were shifted down two inches, and the torque reaction arm was extended down a like amount.

A roll bar, in the form of an inverted "U", was set up just behind the driver. The 2½ inch diameter .040 inch thick chrome-moly steel tubing had to be bent by cutting "V's" and welding. This arch was welded to the frame at each side just forward of the axle kickup, while a diagonal strut was fitted from the top of the kickup to the top of the arch. Additional curved 1¼ inch tubes were welded in as body supports on the sides, and the same material forms the headrest curve.

1¼ inch chrome-moly was also used for the front body and radiator support. Many smaller tubes add stiffness in this area. All welding, by the way, was by oxy-acetelyne with high tensile steel rod.

The standard clutch pedal placing was retained with the lowered power package by inverting the linkage, while the brake pedal stayed put. With these known, the base of the firewall was located and its framing built up of ½ inch conduit tubing. The final covering was 3/64 inch scrap aluminum sheet.

Floor framing and a drive shaft guard were made from ¾ inch thin-wall chrome-moly tubing. Metal screws held the .061 inch aluminum flooring down, while additional inner firewall sheets were welded in at both front and rear of the driver's compartment.

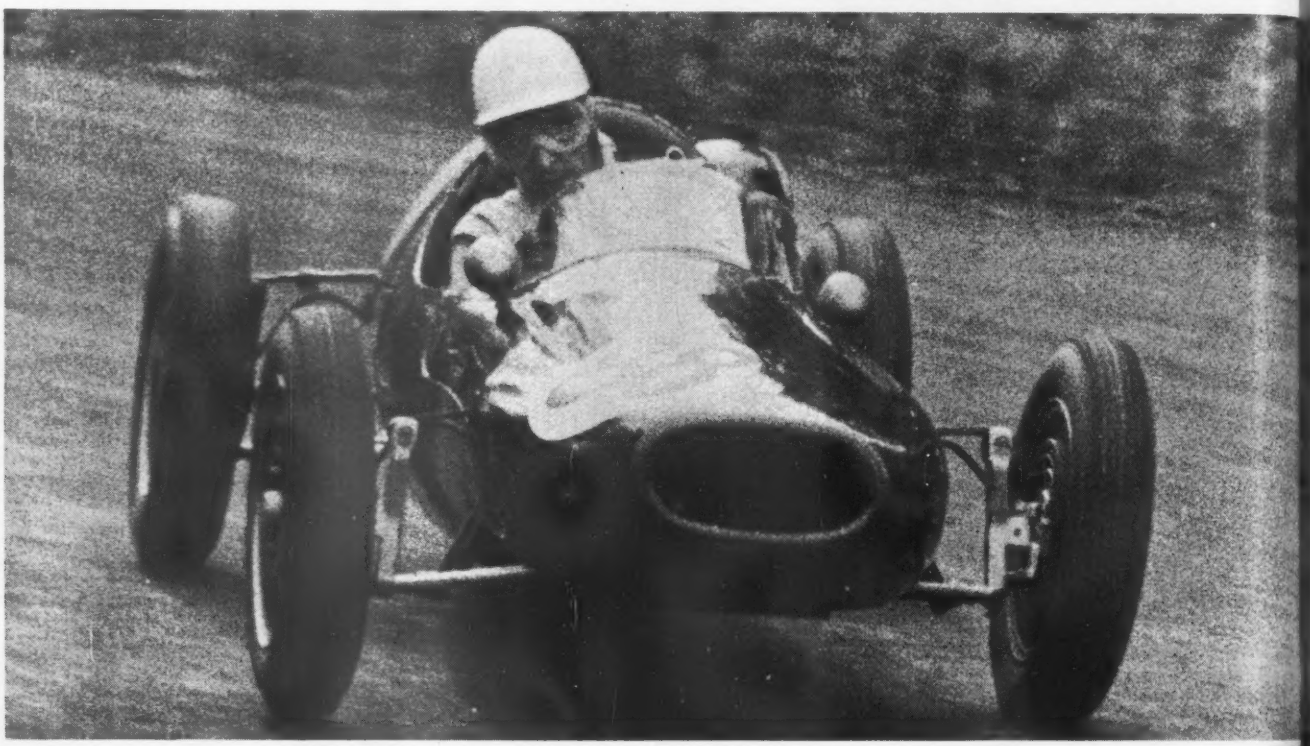
Reynolds aluminum tubing forms the body underframing, and the covering is .051 inch soft aluminum sheet. Inspired by the bodywork on the McClure and Hughes-Kircher Jag specials from Denver, Jack Baird decided to learn how to weld aluminum. Compound curves aren't bad, he says. You just cut gussets and weld up the splits, then form the general shape by hammering on handmade shot or sand bags. When the aluminum gets work-hardened, anneal it by heat-

(Continued on page 61)

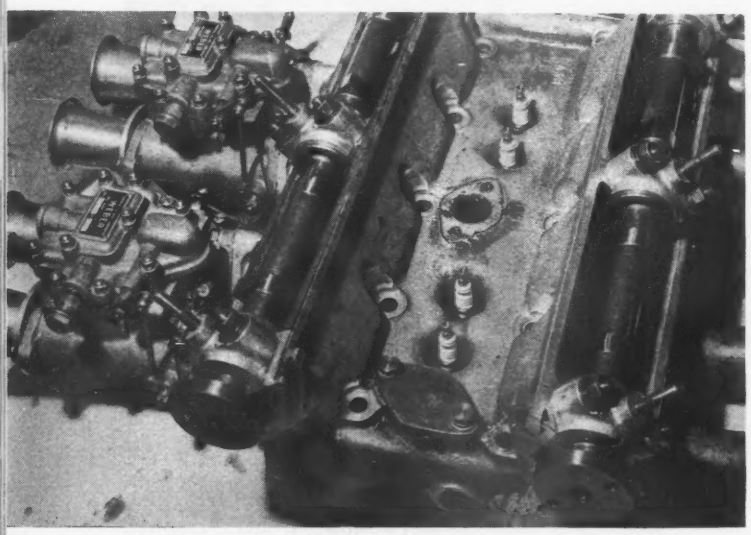
Formula II

Do-It-Yourself GRAND

John Cooper built the first machine designed specifically for the new Formula II, and Roy Salvadori used it to walk away with the initial race for the new G.P. class at Silverstone. Light and simple, it's characteristic of the new breed.



BY KARL LUDVIGSEN *SCI Technical Editor*



Seen here in Bonneville trim, the twin-cam MG head is simple and rugged enough to go into full production. It would then be the most for the least in Formula II.

MOST racing formulas grow out of big pow-wows among internationally renowned figures in the competition world and subsequent conclaves in the sub-basement of the F.I.A. Agreement grows out of hot argument over factors that can affect sales of production cars, national prestige, and the hiring and firing of racing managers.

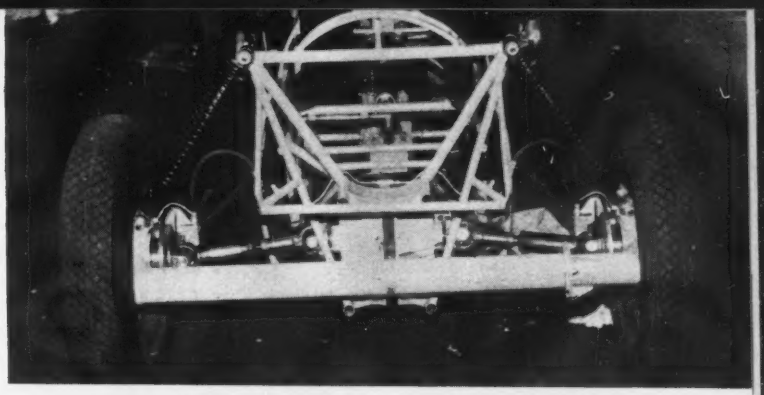
Once in a while, though, along comes a competition class that just rises out of aluminum dust and demands to be recognized. Such was the current Formula III, born in the minds of British aircraft workers to relieve the high cost of racing after World War II. Just a step up from the popular "500's" was the old Formula II which matched unblown two-liter cars against blown half-liters. None of the latter made any impression, and there were a lot of good two-liter engines around in the sports car world, so the resulting genuine Grand Prix cars were simple, cheap and fun to drive. Men like Moss, Collins and Hawthorn found them ideal stepping stones from sports cars to full-bore GP competition.

The door was shut in '54 when the main Formula was cut back to 2.5 liters unsupercharged, and F.II was squeezed out. This channeled the energy of the English back into sports cars, and they proceeded to develop some potent machinery for classes F and G. It didn't take much time or effort for them to realize that they had a tight nucleus for a new Formula II, and the press and the clubs started

PRIX

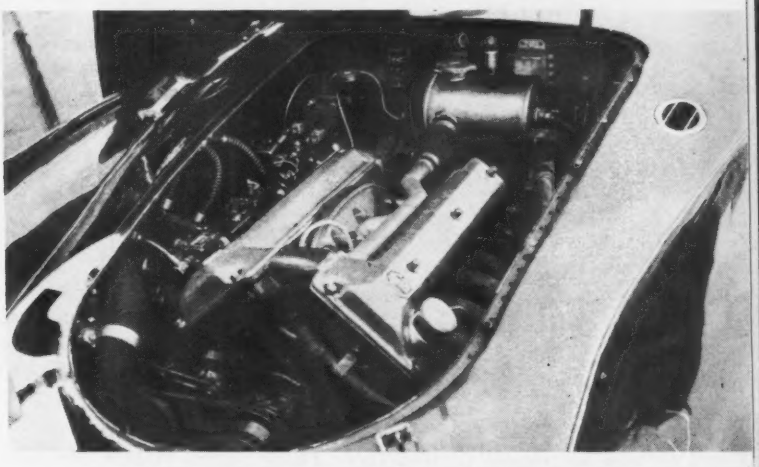
The newest thing in racing, Formula II is wide open for both the professional and back-yard special builder. Here is a guide to the ground floor.

Hailed as the ultimate in the drive to "simplicate and add more lightness", Chapman F.II Lotus will be fully covered by SCI.



ABOVE: Very high spring mounting is used in Lister F.II chassis. Straight DeDion tube is articulated at right, and disc brakes are inboard of hubs for cooling.

BELOW: Weslake-developed DOHC MG head was first seen in A's at 1955 Tourist Trophy. Header tank separate.



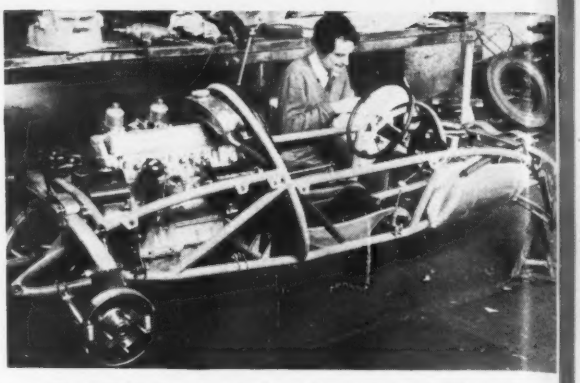
to toss around the idea of a 1½ liter unblown formula. France, Germany and Italy had developed a few rapid Class F sports cars too, so the new Grand Prix class took shape quickly and was met with immediate acceptance. It was made even easier by restricting the cars to 100/130 octane gasoline.

The whole thing was started by the English, then, and they have a pretty handy lead so far. In fact, they ran the first Formula II race (the class is due to start officially in 1957) on July 14, 1956, in connection with the British Grand Prix. Salvadori won that 75 mile curtain-raiser at a speed of 96.00 mph, driving the protoype of a brand-new series of F.II Coopers. The rest of the entry was made up of sports cars of Class F and smaller, but Colin Chapman stripped 60 pounds worth of lighting equipment out of his Lotus factory Mark Eleven and set the fastest lap time at 97.93 mph. These compare with Fangio's winning speed in the Ferrari-Lancia of 98.65 mph over the full 303 mile GP distance. Moss' Maserati was fastest lapper at 102.104 mph. Latest news points to a lap speed of 106 or better for Silverstone in 1957, but the "little boys" were running the old 1460 cc single-cam Climax engine in '56 and they should be proportionately even hotter this year. This is *moving*, gentlemen, and furthermore it's the Real Thing.

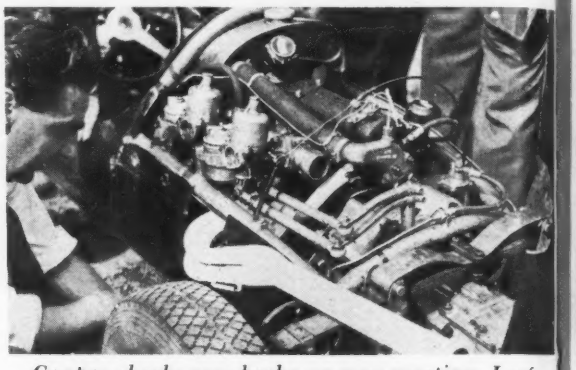
Formula III cars could and can be built reasonably cheaply, but somehow they were always nearer motorcycles than cars and never captured the imagination of this country. A top speed of 110 mph is no longer considered fast, and the small size and ack-ack exhaust note didn't heighten the illusion. At the other end of the scale is Formula I, dominated by factory teams wheeling expensive, complex iron. No place for specials or novice drivers.

This 1½ liter Formula II strikes just the right balance between small size and availability to make it cheap, and has a high power-to-weight ratio for kicks out on the course. What's more, they can be built like their big brothers with-

ENGINE	CYLS. (no.)	BORE x STROKE (mm)	DISPL. c.c.	PISTON AREA (sq. ins.)	BHP @ RPM (stock)
Porsche Super	4	80 x74	1488	31.3	70 @ 5000
Rootes OHV	4	76.2x76.2	1390	28.3	67 @ 5400
Borgward TS	4	75 x84.5	1493	27.4	75 @ 5200
Volvo PV444	4	75 x80	1414	27.4	70 @ 6000
BMC B-Type	4	73 x88.9	1498	26.0	68 @ 5500
Singer 1500	4	73 x89.6	1496	26.0	59 @ 4800
MG XPEG	4	72 x90	1466	25.3	65 @ 5500
Fiat 1400	4	82 x66	1395	32.7	58 @ 4600
Ford Taunus	4	82 x70.9	1498	32.7	60 @ 4250
Opel	4	80 x74	1488	31.3	52 @ 3900
Peugeot 403	4	80 x73	1468	31.3	58 @ 4900
Porsche RS	4	85 x66	1498	35.3	137 @ 6200
Climax FPF	4	81.2x71.1	1475	32.2	141 @ 7000
Maserati 150S	4	81 x72	1484	31.9	140 @ 7500
WD (Denzel)	4	80 x74	1488	31.3	85 @ 5500
Osca TN1500	4	78 x78	1490	29.7	132 @ 6300
Climax FWB	4	76.2x80	1460	28.3	100 @ 6000
AJB F.II	4	76 x82.5	1498	28.2	125 @ 5750
Meyer-Drake	4	76 x79	1440	28.2	100 @ 6500
Meyer-Drake	4	73 x89	1490	26.0	100 @ 6500
Ferrari V-12	12	55 x52.5	1498	42.2	118 @ 7000
AWE	6	66 x73	1499	31.9	135 @ 7000
Borgward R	4	80 x74	1496	31.3	140 @ 7600
Gordini	4	78 x78	1490	29.7	120 @ 6200



First F.II Cooper is based on potent Class G sports car. New editions will have twin-cam engine, wider frame and bigger fuel tanks.



Cooper checks rear brake on new creation. Leaf mounting, shift linkage, cooling system and Citroën gearbox adaptation speak for ingenuity.

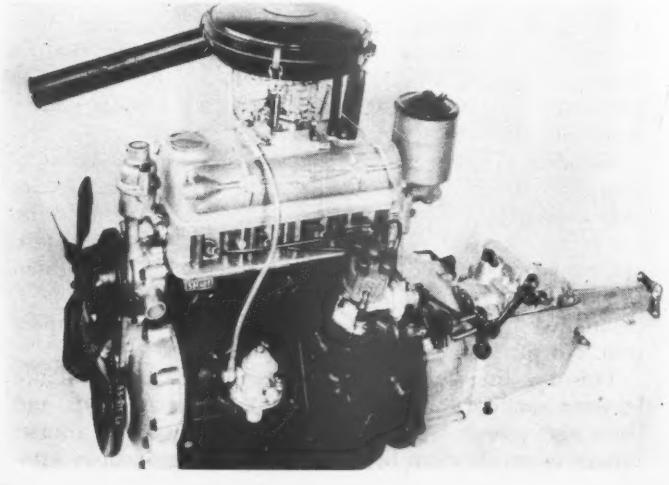
out sacrificing performance. These points endear the new F.II car to the private builder, while the factories take an interest because they know that recent history has shown each secondary formula to be a forerunner of the next Formula I. It's a good research move for them.

In England the big newsmaker has been Coventry-Climax who has been around for a long time and has primarily busied itself with industrial engines. It built small-displacement engines for sports cars before the war, notably for Morgan, and followed through in 1954 with the versatile FW series of single-overhead-cam four-barrels. The now-famous 1097 cc FWA engine had a bore and stroke of 72.4 by 66.7 mm. A slightly larger bore and new crank brought it up to 1460 cc as a stopgap for the new class. This was the FWB, which has now been supplanted by the DOHC, FPF engine. Developed from half the C-C 2½ liter V-8, the new engine weighs 255 pounds bare, or 50 pounds more than the FWB. Its 1.75 inch intake valves help it to kick out 41 more horses, though, and the design throughout is for racing only. In comparison with the full-bore Italian engines it has a lot of bolt-on plates and covers, but these may aid fitting and assembly by the private owner.

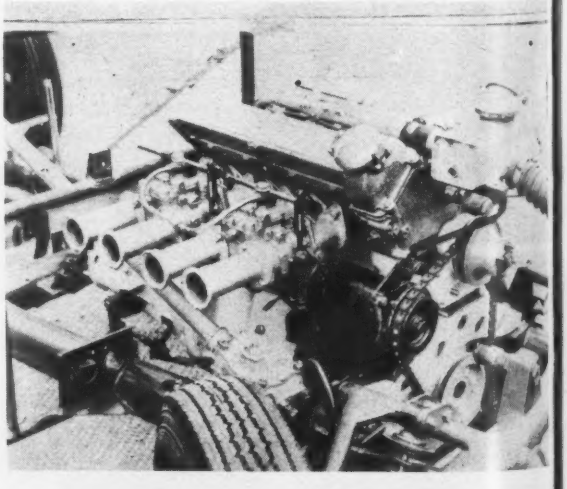
MG has also kept up the Class F reputation of the Isles. A lot of very heavy "tuning" has been carried out on the 1466 cc XPEG series which, in some cases, was boosted to a very reliable 90 horses. With the U.S.-built Runyan twin-overhead-cam head, 110 bhp could easily be reached, judging by early tests on an XPAG block. The care and feeding of this MG engine is now ritual to most capable sports car mechanics, and it's rugged and available.

Now found in the MGA, Morris, Austin, Wolseley and Metropolitan, the BMC Series B engine is far healthier than

Production Borgward four has deep crankcase, uses light alloy extensively. Integral intake manifold is challenge to modifier.



Twin-cam HRG head for Singer was promising development, but only one Singer prototype was built. Distributor is under twin Solex carbs.



its forebear, the Austin A40 unit. These are being stamped out like cookies at 4,500 a week and there are a quarter of a million around, so one shouldn't be hard to find. Much of Harry Weslake's talent has been turned loose on these and has produced an efficient standard cylinder head and a tricky induction system for the '55 Le Mans MG's. There's also the new chain-driven twin-cam head which, in its most modest form at Bonneville, was good for a hundred horses at 5,300 revs. Its future is much brighter than its past .

Rootes is now holding a wake for the Singer four-barrel which is dying far before its prime. With a single overhead cam and semi-inclined overhead valves its standard head is by no means outdated, and the similar twin-cam heads developed by HRG and Singer would be very nice for Formula II. The side-draft HRG version developed 108 bhp at 5,750, while the vertical-port Singer prototype was restricted to 75 horses. Any Singer 1500 Roadster, though, is more than fair game in stock form. These single-cam engines can take reworking to the point where they'll produce approximately 100 bhp.

The rest of the Rootes small cars (Hillman, Sunbeam Rapier) are powered by their rocker-box four, which is now a mere 1390 cc but has a square bore/stroke ratio and could be bored quite close to 1500. Most promising, it has a genuine eight-port head with a big margin for further souping. It's one of the most modern small English production engines.

Out of this class entirely is the flat-four AJB racing engine which is a smaller-bored version of Archie Butterworth's Formula I engine. With its swing valves and advanced tuning it's one of great technical interest, so check our report on it in this issue.

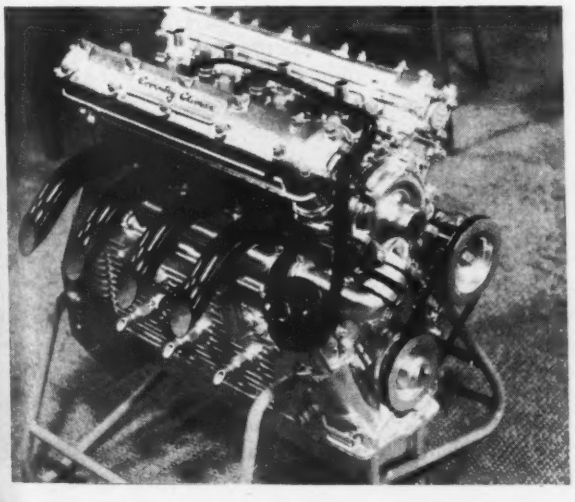
Just over the channel, racing interest has been largely limited to 750 cc machines, but French honor has more than once been upheld by Gordini's bigger creations. Back in '47 the unblown version of his 1½ liter four was putting out 100 bhp and 120 would be available now, but he has a new plant based on half the current GP straight-eight. It performed well at Montlhéry as long ago as June 10, 1956 and is already producing 140 hp. All that running on gas with the big engine finally paid off.

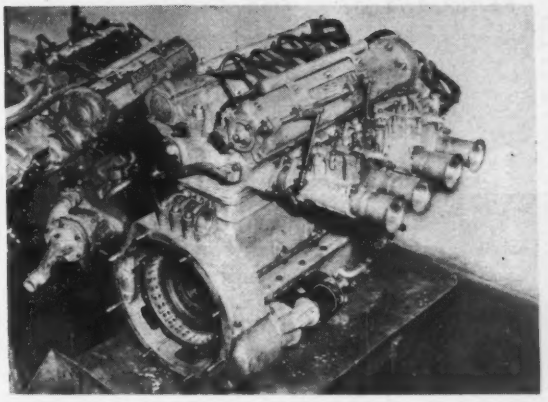
The Gauls hope that Marco will follow suit and cut up his Colombo-designed Bugatti eight, since he has been talking 1½ liter sports cars for so long. They also would benefit from experience with 100 octane.

Much more available, though that's not saying much, is the Peugeot 403 engine. This has a big bore and short stroke,

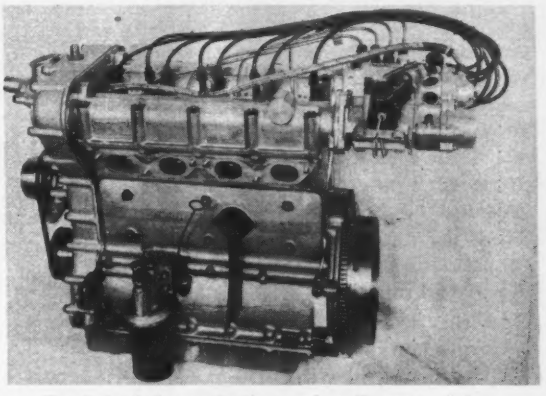
(Continued on page 66)

In sports form (with generator) new FPF Climax engine is a pure racing unit. Fittings for dry sump system are at side of crankcase.

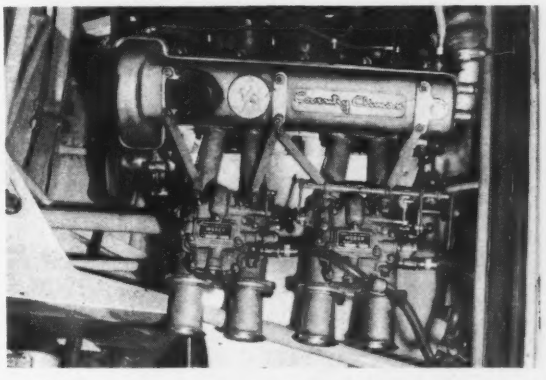




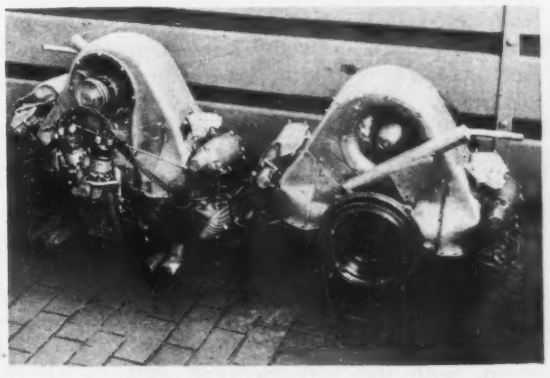
Hot 2-liter Maserati four differs from 1500 cc unit in having bigger pistons and wet liners. Little brother should be watched in F.II.



Real dark horse is the racing Borgward four, which crowds four valves, two plugs and an injection nozzle into each head chamber.



More go for single-cam F.II Climax engines will come from twin dual Webers. Hilborn now has port injection system for these.



Latest RS Porsche engines have more direct distributor drive and refined valve gear. Porsche denies interest in new GP Formula.

Earl's Court

(Continued from page 13)

It is fun, too, seeing the experimental extravaganzas that won't ever wind up in the local sales rooms. Jet jobs are represented in London by Renault's highly Buck Rogers-like Shooting Star, and Rover's down-to-earth effort named (so that even the dunces in the back row could get the idea) the "Rover Gas Turbine Car." This third prototype looks not too different from some middle-sized little car you're apt to see on any city street, but the design isn't salable yet, due principally to the tremendous appetite it has for fuel—13.8 mpg at 40, and one mile less to the gallon at 80. There's also a little too much of the works inside to carry both passengers and luggage. As the layout now stands the passengers look comfortable enough, but when they enter they have to leave all their worldly goods outside.

In the dream car department, the only contribution comes from the U.S.A. That's Buick's show-weary veteran, the Centurion, with its nonsensical closed-circuit TV rear-view mirror. I expected that the British reaction to this tomfoolery would be cynical talk about cracking a nut with a pile driver; instead, the nearest thing to an adverse comment I managed to overhear was from a woman who was disappointed that the screen was so small.

The enthusiasm for dashing foreign creations at American shows is nothing compared to the stir created by Detroit's article overseas. That is certainly true of London, where 16 makes were on view. A Chevy Corvette, which might draw an occasional approving glance back home, but isn't likely to make anybody swoon unless they suddenly won it on a quiz show, stops the crowd dead in their tracks as it revolves on its turntable. The Ford Thunderbird, considered—let's not beat around the bush—a bit vulgar by the Duesenberg set, causes a never-ending crush around its stand. And the trim little Nash Metropolitan makes Britishers drool and ask, "Why can't we build something like that here?" They can and do—the Metropolitan being an Austin-built dollar export item.

The last stateside tidbit from the continent where people think all Cadillacs are solid gold, turned up rather unexpectedly on the Perkins Diesel stand, with the announcement that Chrysler was now supplying its European distributors with Perkins P4C four-cylinder diesels, as alternative power plants for the Plymouth range. Diesels have come a long way since the days when their idle was so rough that a two minute wait at a traffic light would shake all the little screws out of your eyeglasses.

In "English" English, the word "clever" means something halfway between ingenious and downright shifty. The people whom a leading motoring magazine recently referred to as "clever constructors abroad" are giving British constructors a run for their money at the bottom end of the market—the tiny economy car. Customs duties do an effective job of keeping Volkswagens, 4CV Renaults, 20CV Citroëns, and Fiat 600's from biting off too big a piece of the territory reserved for Morris Minors, Austin A35's and suchlike small stuff, but now there is a threat to hometown boys in the even-smaller-than-that class; the tiny, two-stroke cyclecars. Seen in England for the first time at the Show is the microscopic, outrageously spartan little German vehicle dubbed the Goggomobile. This 293 cc mite go-goes at sixty with two grown-ups and two kids aboard, and delivers over sixty miles to the gallon.

Britain's answer is the Berkeley, a plastic-bodied two-seater built by Lawrence Bond, designer of the Bond Minicar, most popular of the poverty wagons. The Berkeley has a claimed maximum of over 70, and cruises between 55 and 60, requiring 20 seconds to go from zero to 50. Easily the best looking of the miniatures, the new Bond creation is full of odd features. It is the only British car with front-wheel drive, and very likely the only car anywhere with a nomadic spare wheel which folds up its tent on demand and moves from a space behind the seat to a bracket under the dashboard.

This is so that its quarters can be used to accommodate either one large child or two small ones. They're in for a rough ride, though, for their plastic seat is moulded integrally with the body. Aimed to fill a hole in the market, this poor man's sports car retails in England for $1610 and some change, the Goggomobile at $1385 plus.

After these two little comedians comes a whole slew of popular priced transportation—the cars my reporter friend dismissed as "potato-shaped." Although I won't go out and out battle with anyone who finds them not beautiful, I don't really think they're as bad as all that. Of course, there are some downright ugly ones – the trend this year seems to be bumps on everything, with a different color between each one.

On the other hand the new English Fords – particularly the convertibles – are sleeker than ever. Rumor has it that they are all designed in Detroit and the drawings forwarded to Dagenham. If so, it might not be a bad idea for Britain designers to buy themselves some heavy sweaters and shiver out the winter in Michigan.

There aren't any other facades quite as classic as the Mark VIII front end, and one can't help wondering what happened to the people who used to design all the elegant coachwork Britain was famous for a mere twenty years ago. Even today, when you see an unfamiliar-looking vintage car with an exquisitely proportioned body, seven times out of ten it turns out to be an Alvis. So what happened? The new Alvis turns up with a Swiss-designed Graber body. Not that it's not good looking in a stark way – but what happened to the *old* Alvis designers? While you're looking for them, see whether the drawing-board termites have gnawed to a nubbin the fellows responsible for those magnificent, mechanical-looking Aston-Martins of the 30's.

Well, looks aren't everything. Colin Chapman's Lotus Elevens all resemble pregnant wasps, but they're pretty terrific in action. And if anything manages to squeeze this dismal automobile show into the history books, chances are it will be the debut of the Lotus F2, a simple, skinny, 600 pound single-seater that marks Chapman's opening bid for a spot in formula racing's hall of fame.

The car and its 1,475 cc twin overhead cam, Coventry Climax engine haven't yet got together for a romp. The engine is still on the test bench, and the five-speed back axle gearbox on the show prototype is just a cardboard mock-up. Nevertheless advance notices on the F2 have been so promising that a dozen have already been sold. One purchaser was Rene Bonnet, French racing driver, who designed the Dyna Panhard-based DB—no slouch of a competition machine itself.

Twelve sales is a pretty remarkable record for a specialist's pure racing car especially one that hasn't even run yet, let alone raced. However, when it comes to sheer numbers, the high-sales trophy goes to the Austin-Healey 100 Six, a thousand of which were bought by Hambro Automotive Corporation – British Motor Corp's. U. S. agents.

San Francisco gets a chunk of another Hambro consignment: 470 of the new M.G.A. coupes. California dealers are said to be trying to buy an ex-U. S. Navy baby aircraft carrier to ferry their purchases home, but whether this is true or just a press agent's dream, there's no good way of telling at this distance. It would, in fact, be a good thing if this were a publicity stunt, for this show could have used a little lighthearted American press-agentry.

—Merwin Dembling

JAGUAR

the finest car of its class in the world

. Gardner

(Continued from page 25)

far from bankrupt of imagination; he knew well enough that if EX 135 ever flew off the handle at upwards of three miles a minute his chances of wriggling out of the wreckage were reduced to practically zero by two interrelated factors — the tight fit imposed by his above average height and his lack of elasticity. Once in the cockpit, leaning back in his hammock at the 40 degree angle dictated by frontal area rationing, and with the oblong-shaped steering wheel snapped into place athwart his navel, he was surely *in*.

Moreover, even if it never came to the point of having to jettison the wheel for a breakout — and it didn't — it wasn't difficult to imagine circumstances where the MG's limited helm movement could render the driver practically helpless. Lock to lock range, circumscribed by the side sections of the nose fairing, was only 18 degrees; so if for any reason the car went into a spin, or in the likelier event of an unexpected gust of wind nudging it off course to any appreciable extent, the Colonel knew he would have some fa and persuasive praying to do.

The only time that either of the things happened, as good luck woul have it, was in the one records theate on his list where it could happen wit impunity — Bonneville. This was du ing his final foray in 1952, and fo lowed soon after the oil temperatur hallucination recalled earlier. Opera ing EX 135 with the larger of th interchangeable engines that wer taken to the Flats that year — a tw liter Wolseley job, type VC22 — Goldi started chasing his tail at 155 mph o slick salt.

Again, in 1948 on the Jabbeke High way in Belgium, when Jaguar lent two liter XK 100 engine for use i EX 135, there were delicious excite ments. On one of the two runs that gav Goldie an overall average of 176.6 mp for the flying kilometer, the right-side front tire tread flew off, throwing th wheel into an out-of-balance tantrum before disintegrating and falling out on to the concrete. This, in any case, wa no joke while it lasted, but it could have been deadly, due to the confined space inside the wheel boxes that were built into EX 135's shell to reduce pumping losses.

It wasn't until after Goldie's triumphal return to his hotel in Ostend the same evening that he learned how nearly he had missed being intercepted in the middle of the trap by positively the slowest rig in Jabbeke precincts, namely, a donkey cart. I happened to be an eye witness of this affair, and it frightened me stiff.

As Gardner came streaking down the road at a good 175, the donkeyman, apparently deaf but anyway oblivious, emerged from one of the few unguarded farm exits on the whole operational stretch, some six miles in length. Confused by the frenzied "giddaps" coming at him in three languages and from four directions, the donkey then froze to a dead stop in the middle of the highway. With just seconds to spare the whole outfit was half lifted and half dragged to the nearest verge.

Characteristically, in the course of his many visits to the U.S. he hobnobbed with countless notabilities from Clark Gable through Pop Myers to one of the Vice-Presidents of the United States. The only surprising thing is that he settled for a *Vice*-President.

On the other hand, he was invariably considerate and courteous to his mechanics and all persons dependent upon him, and never missed an opportunity of publicly praising their efforts. Guts, or the lack of it, is something a race mechanic can smell a mile away.

(Continued on page 54)

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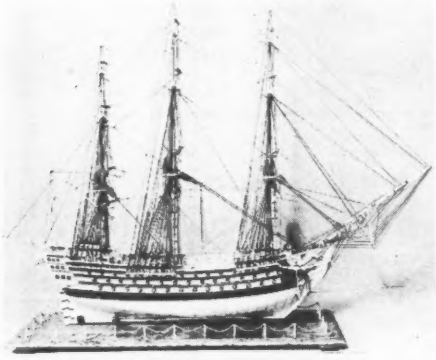

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Gardner *(Continued from page 53)*

and the men who worked on EX 135 and her predecessors knew that Goldie had more fight in him than a lion with a bullet wound.

I once heard a tire fitter say of him, in the vernacular of his trade, "The old man never shows his breaker strip." The speaker knew that Goldie, like any person of imagination, had a breaker strip to show, and there were times when long and unforseen delays pending a critical record would stretch his nerves to snapping point; but outwardly, by the habit of self-discipline that is often observable in old soldiers, he preserved a flat calm—no fussing, no cussing, no tabbing out of half smoked cigarettes (he always smoked a straight-grain pipe, anyway), no poking his nose into mechanical mysteries beyond his modest ken.

As Goldie Gardner would certainly agree, only a fraction of the credit for EX 135's attainments rightly belongs to him—the rest gets chalked up to Sydney Enever and R. C. Jackson of MG, Ken Taylor and Reid Railton of the famous Thompson and Taylor partnership, independent expediter Robin Jackson, S.U. mastermind Kes Kesterson, Wally Hassan of Jaguar, Chris Shorrock of the Shorrock blower team, and many who remained anonymous throughout. Yet Goldie and the streamliner were so inseparably associated that no profile of him would stand scrutiny unless it included a catalog of his car's principal successes. Arranged in descending order of displacements, it looks like this:

Class E, 1500 to 2000 cc: First car to exceed 150 mph, powered by Jaguar XK100 motor. This was the only class in which Gardner went outside the Nuffield Group for an engine. EX 135 hoisted the kilometer mark, previously held by a Franco-U.S. Derby-Miller, by over 30 mph.

Class F, 1100 to 1500 cc: Firt car to beat 220 mph, 300 kph and three miles per minute.

Class G, 750 to 1100 cc: Same again. Gardner's 1100 cc speeds in 1939 corresponded almost exactly to Segrave's Land Speed Record figures of only 12 hours earlier. Segrave had needed 24 cylinders, each of 122 by 160 millimeters.

Class H, 500 to 750 cc: First with a century and a half.

Class I, 350 to 500 cc: First to two miles per minute, 150 and 200 kph.

Class J, up to 350 cc: First to two miles per minute.

First time out, in 1938, when the second-hand EX 135 was rebuilt for Goldie Gardner's use, the engine was run at the normal K3 Magnette displacement of 1087 cc. Blown by Centric, it delivered 186 bhp and attained a best two-way speed of 186.6 mph over the kilometer.

The following year, practically unaltered, the same engine pulled a higher gear to raise its own Class G records past two centuries, then was fractionally overbored on location to bring it inside the Class F scale. In this size, with its bores up from 57 to 58 mm, making the displacement 1105½ cc, it pushed the MG over the mile and kilometer at 203.85 and 204.20 mph, respectively. The mile speed, incidentally, added almost exactly 40 mph to a mark set by the late Frank Lockhart (Miller) 12 years earlier.

Next objective was to procure a workable 750 cc six without departing from the basic K3 elements. This was done by forging a short-throw crankshaft to dwarf the stroke to 56 mm and casting a special thick-wall enabling the cylinders to be underbored at 53 mm diameter. In the result, in spite of a perforcedly low nominal compression ratio of 5.1/1, the combustion of a highish boost and an 8000 a minute turnover produced about 131 bhp. And that was good enough for 159 mph in 1946, in the runs that inaugurated the Jabbeke Highway.

In 1935, MG anticipated a Mercedes gesture of twenty years later, pulling a *volte face* on their previous policy by quitting unconditionally; so Eyston sold EX 135 for the good and sufficient reason that no racing department remained at Abingdon to breathe continued life into his stripy painted *bolide.*

But fortunately for the subsequent history of high speed by small British cars, Lord Nuffield and his lieutenant in charge of MG, the late Cecil Kimber, were persuaded to relent to the extent of preparing a full streamliner for Class G records. The man who made them change their minds was Arthur Thomas Goldie Gardner, alias "The One-Legged Major."

However, since the Abingdon stock-in-trade did not include the makings of a suitable car, there was no option but to seek out the man who had bought Eyston's super-annuated EX 135, buy it back and rebuild it. This they did, and the veteran of the Mannin Beg, the British 500 and the hour record entered its third lease of life in a suit of aerodynamic armor that was to set a fashion in streamliners for two decades to come.

Remarkably enough, like most of the amateur copies that were afterwards made of it in at least two continents, this body never saw the inside of a wind tunnel. Like all the creations of Reid A. Railton, it looked right and it was right. Gardner, if he wasn't exactly a Uhlenhaut himself, certainly knew a Uhlenhaut when he saw one.

Dennis May

Veloce

(Continued from page 17)

around corners, the driver is allowed to safely meet any sudden emergency. Under certain circumstances, to take the power off in the corner would invite disaster for the car is literally steered by provoking rear end breakaway and then controlled by proper use of the throttle and steering wheel. The brakes have three inch wide drums, and are heavily ribbed in front and finned at the rear. Little pressure was required to bring the car to a quick stop, even though the car had just completed a race at Monza. Under sudden acceleration on rough surfaces, a certain amount of rear axle bounce is noticeable, but this does not seem to upset the handling qualities of the car at all. This is due undoubtedly to the location of the A-frame which is mounted on the upper left of the rigid axle. Shocks and springs on the Veloce are considerably stiffer than on the normal Sprint version. Thus the overall ride is considerably harsher. Tire noise was found to be excessive but this may have been due to the 15 inch Pirellis and the hot pavements encountered.

In summing up the Veloce, the most outstanding characteristic of the car is the flexibility factor. Second gear can

be used almost continuously on short choppy race courses, and in normal driving is a wonderful gear for maneuvering in traffic Secondly, the flexibility in handling makes for complete security when driving hard and the driver of a Sprint Veloce will almost immediately have complete confidence in his car. Amazing things can be done with it and it's probably the most forgiving car on the road. A fast driver can make all kinds of mistakes in a corner and still come out ahead. A relatively large amount of luggage and child space is available, thus making the Veloce a really practical sports car which can be used on shopping expeditions the day before going off to a weekend race meeting where the car will take on all comers. In short, here is a true Italian competition machine with just enough comfort and flexibility left in the design to make it a really outstanding piece of equipment.

Jesse Alexander

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Corvette

(Continued from page 29)

CAMS AND VALVE TRAIN

The unforseen rpm potential and top-end breathing of the Chev V-8 *in stock form* are already legend. Thousands of enthusiasts are asking if there is anything to be gained by putting money and effort into modifying this apparently fine cam and valve train setup. After two years of observation and after careful study of a number of dynamometer test results that cannot yet be made public, my answer to this question must be an unqualified "yes".

The manufacturers are grinding their own "full-race" cams these days but they still have to compromise. Hydraulic lifters cause a certain performance sacrifice as does a half-way decent idle. The stock curvature and width of the tappet base are limiting factors in cam action. A wide selection of production cams has become available for the Chevrolet V-8 since its introduction in 1955. There have been cams for solid and hydraulic lifters, cams for stick shift and automatic transmissions, cams for dual quad carbs on passenger cars, cams for the Corvette and, of course, the well known "Duntov" competition cam. The latter is being continued unchanged for '57. From all I have been able to dig out, only the Duntov cam can show a peak horsepower output comparable with the better California "performance" grinds. The passenger car cams, even though they may sound real wicked over 5000 rpm, are way out of the picture and even the standard '56 Corvette cam (for solid lifters) may be as much as 10 or 12 percent off the better California kits using flat solid lifters.

Of course, there are many factors involved in cam selection. For one thing, there must be metallurgic compatibility between cam lobes and lifter faces to prevent rapid wear at high rpm. You need have no fears about this if you use factory parts, but some of the specialty cams can't be trusted under hard operating conditions. Another factor is valve float speed. If you use your Corvette much for competition it's very pleasant to have 1000 rpm or so in hand over the power curve peak, so you can play with the gears and downshift without being afraid of wrecking the valve gear. It has been found that float speed is heavily influenced by valve spring pressures and cam acceleration (on both flanks). The standard '56 Corvette cam can be counted on for only about 6100 rpm, when using the stock 160 pound spring pressure at the valve-open position. The California cams I have test figures for, even when using well over 200 pounds pressure, would vary anywhere from 5600 to 7800 rpm in float speed!

And there's a little matter of money. You can buy a Corvette cam these days over the counter for $18; it's a simple matter to collapse your stock passenger car hydraulic lifters—and you're in business with a "racing" cam. A good California flat cam kit, including compatible lifters, springs and possibly pushrods, can run you over $200. That's a lot to pay for a 10 or 12 percent increase in horsepower. At the same time, the Duntov kit lists over the counter at around $180, which isn't hay.

Finally, there's the question of the roller cam. Since a small roller is used for the cam follower here, cam contours are not limited in any way by lifter base width or radius; the sky's the limit on lift, rates, dwell, etc. A good roller cam should give substantially more peak output than any of the flat-lifter family, custom or factory. The lifter is heavier, however, so more spring pressure must be used to keep the float speed above 7000 rpm. Medium-speed torque is usually poor, but there's no reason why you couldn't have one ground for a wider range. Prices are relatively high. The Herbert kit for Chev lists at $175 and the Weber at $225. They differ mainly in the method of locating the tappet. So I'll go out on a limb with these specific cam recommendations. If you want to stay strictly "production", the Duntov is definitely the only answer. For a flat or radiused-lifter cam kit in the custom category, Iskenderian and McGurk products look good. The Isky "E-2" grind is specially well-matched to the Chev V-8. For a roller type, both the Herbert and Weber are good cams. The roller layout is preferable for any "all out" engine.

Modification of the Chev valve train itself is a very controversial subject. Some experts say the light weight and great stiffness of the unique stamped rocker arms and tubular pushrods are keys to the fantastic performance of the engine. These would greatly reduce deflection of the valve train, so the valve motion would follow the cam more closely, which, in turn, is a big factor in breathing. Could be. Others feel this valve setup is too flimsy for really high rpm work. Some have gone to great lengths to install complete rocker assemblies from other engines on the Chev head. Thomas has a kit selling for $95 for converting to a regular rocker shaft and cast magnesium rockers by threading the original Chev rocker stud holes to bolt in the new rocker stands. Very neat.

CARBURETION

The Corvettes have a lousy carburetion system for a sports car. A four barrel carb has a wide fuel bowl, which makes it very susceptible to fuel starvation under centrifugal force on corners. *Dual* four-barrel carburetion is no cure-all, either. We have the same starvation problem, plus poor throttle response and mixture distribution at the low end. The manifold layout is not the best from the standpoint of breathing restriction at the top end and the usual linkage synchronization problems exist. The Corvette team had a foolproof non-starving dual-quad setup at Sebring '56 but you may not want to carry five electric fuel pumps around. If you must use a four-barrel carb, one is a better all-around compromise than two. It should show more torque below 4000 rpm, better throttle response, no linkage problem, and it should come within three or four percent of the peak horsepower obtained with two!

I prefer *three two-throat* carbs for the Chev V-8. Several California companies now have the necessary 180 degree manifolds, and any of them should show more peak bhp (other factors equal) than the stock Corvette dual quad setup. The Carstens HWM Chev is a case in point. Throttle response is better, low-speed torque is better, the linkage problem not appreciably worse (though still a problem) while the smaller fuel bowls practically eliminate fuel starvation on turns. A new twist on this setup is Edelbrock's novel "progressive" throttle linkage. The center carb only is used for cruising; at some pre-adjusted throttle opening on this carb—maybe two-thirds open—the throttles on the two end carbs start to open at a faster rate, and all reach full open at the same point. Olds is now plugging a production version rigged to open fully at the ¾ point.

Same deal with fuel injection. The stock '57 system is very clever. It gives excellent throttle response on the road, fair low-end torque, reasonably convenient street operation in all kinds of weather, a negligible horsepower margin over carbs, and no fuel starvation. It would probably be superior to any carb setup for production racing if only for its responsiveness. But for competition in the *modified* category it would be a poor substitute for the famous Hilborn racing injection system. This meters fuel according to throttle position only, so the air flow restriction of venturis and manifolds is eliminated. It's not yet suitable for the street, but it should show a peak horsepower margin of seven percent or so over the standard Chev f.i. system in competition trim.

Supercharging is another possibility for the Corvette engine. At present both McCulloch and Latham have kits. When we get up in this 250-300 bhp

range, the percentage boost given by these units is not the 40 percent claimed, but more like 20 percent. This is because the *air flow* capacity and not the pressure capacity of a blower is limited; the engines keep getting hairier each year while the blowers mark time. For big stuff like the Cadillac and Chrysler engines, the little blowers are gasping for air. They will, however, still provide a useful boost for the Chev engine.

EXHAUST

The stock Chev exhaust manifolds can't compare to streamlined headers welded out of steel tubing—which actually will give a mild *extractor* effect. Several California companies supply these headers for Chev passenger cars, but, as far as I know, demand for Corvette units has not yet been sufficient to warrant tooling up. Custom installations can be had for less than $100, however. The popular Hedman kit fits the '55 head ports well, but is a trifle small for the enlarged 1956 version.

IGNITION

Stock Corvette ignition will do an adequate job in the usual speed range up to 5500-6000 rpm. When breathing is substantially improved by the foregoing modifications, things get more touchy. A hot 30,000-volt coil (Bosch, Mallory, D.S.M., etc.) is the first step. Then replace the entire ignition system with one of the high-quality custom sets like the Spalding "Flamethrower", Mallory "Magspark", or Jackson "Roto-Faze". These are all excellent ignitions, and should handle any load or rpm you throw to them. Magnetos are no longer considered essential on all-out engines, due to the tremendous improvement in coil ignitions in the last four years.

All the above changes will throw heavy loadings on the bottom end of the Corvette engine, which so far seems to be healthy in this department. The lively response and revvability of the Chev may also be due to the fact that its crankshaft, at 47.75 pounds, is the lightest in the industry by three pounds. The 19.02 ounce rods are also the lightest than can be had. This all spells low rotational inertia, or less shafting weight to be accelerated—like cutting down the flywheel.

With these points and provisos in mind, you can jump into the racing fracas with a power package that isn't awed by anything with a foreign accent. In a light, maneuverable chassis the Chev will nibble hungrily at any and all opposition, irrespective of price FOB Modena. With experimenters now working on single-overhead-cam conversions and Bosch injection installation, the limits are still way out of sight. This is the "flathead" of the future, men!

—Roger Huntington

Arnolt-Bristol Drivers

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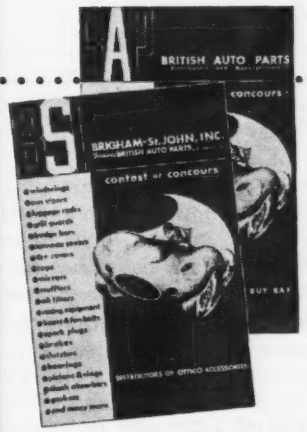

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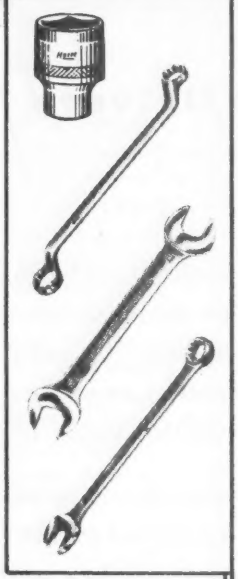

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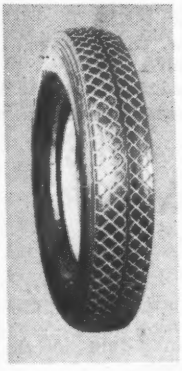

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Crosley

(Continued from page 21)

The addition of the latter prompted Harry into doing away with the four pipe exhaust system. A pair of two pipe headers were made up and run along the lower right hand side of the body. These were made with a union so that the straight pipes could be easily removed and replaced with a muffler. If any loss of power resulted from the changeover it was not measureable. The crackle of the four stacks reminiscent of two synched 40 cubic inch T-Bird bike engines will always be missed by all who know the car. (Excluding the competition, of course.)

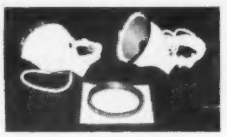
Right after the wild ride on the Sacramento course, Harry decided to rid the car of its last weakness—the crash box. He had considered using an M.G. TC box, but by pure chance he came upon a Meadows box once used in a Jowett Jupiter Sport. The ratios sounded good to him so he adapted the box to the Crosley flywheel housing and torque tube. For the first time the car was adequately geared. Out on the course in '56 the new combo proved unbeatable in class and a top threat to the big stuff in the unlimited events on medium, long, or the short twisting circuits. Naturally, with the Crosley's top speed of only 100 mph the biggies can haul away on those long airport straights. But, they must always slow for the turns. Anyone who witnessed the Eyerly Special's performance at Pebble Beach in '56 must have noted that only the shortest, tightest chicane forces Harry to use his binders. He counts on a consistently high average lap time and complete reliability to place him in the lead at the END of a race. And that strategy has earned Eyerly a lot of hardware.

"The original idea behind the development of the Crosley Hot Shot was sound," says Harry, "they just didn't take it far enough. The engine is nothing short of amazing."

Odd as it may seem to some, the wee mill used to power Eyerly's scarlet special is mild compared to its racing contemporaries. But, it has always been utterly reliable. It has never been found necessary to rev to greater than 7,500 in gears and only on occasion has it been pushed past 7,200 in top. The greatest surge of power is felt at 5,500 rpm—that is the level used for coming out of turns. This was difficult to do with the stock gear box, but not now with the close ratioed Jowett. All parts in the engine are as of the reconstruction in '53, including the K.L.G. F 100 plugs.

Asked for a winner's formula in building a special, Harry replied, "Keep it simple."

Peter Sukalac



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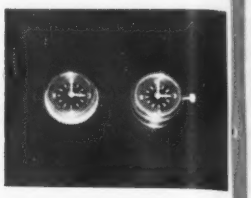

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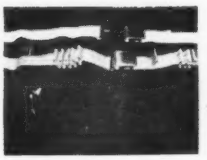

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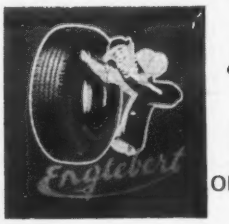

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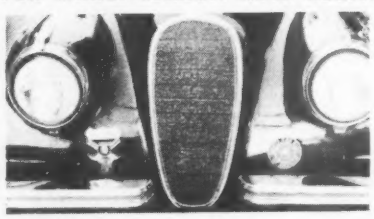

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Spyder

(Continued from page 37)

frequency noise audible in the cockpit. The screaming duet of engine and exhaust is carried away behind you. The result of these facts is that the Spyder taxes the driver very little. While a one-hour race can leave a Ferrari driver too weak in the legs to walk without limping and too weak in the arms to pick up his trophy, the Spyder leaves him with no more than a reasonable sweat.

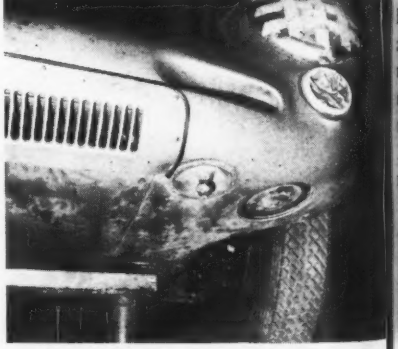
For this reason, plus the fact that the Spyder is a heavy, solidly-built machine, it is difficult to contradict Miles when he calls the Spyder the finest long-distance race car in the world.

"A Spyder will go round and round a desperately bumpy course like Monza," he says, "and nothing will fall off. Meanwhile the lightweight racing cars in its class are likely to have broken in half. The Spyder is strong. For any long race—for Mexico, Rheims, Le Mans, Nürburgring—nothing can touch it. On courses like these the low driver-fatigue and even the high but narrow peak-power range pay off.

"The engine, if you don't over-rev it, is entirely reliable, and seems to have no weak points. One of our local drivers, John Porter, put 700 racing miles on his before opening it up. About all we ever do is change plugs. At the last Sacramento race it's true that I threw a rod, but this came as no surprise. The engine I was using had started out in life as an 1100 cc. It did a season of racing in Europe, including Nürburgring and Le Mans. Then it came over here and ran at Sebring. After that it got a set of 1500 cc barrels and raced a season in the east. Then we got it. We raised the compression, put the valve spring pressure up, and substantially over-revved the little engine in three races. It hadn't been apart for three years and we knew it was due to blow any day, but it was running so nice and loose that we didn't want to tamper with it. It had a perfect right to let go when it did."

The Spyder engine is one in which everything is adjustable and consequently it's quite easy to get something out of adjustment. But it's a simple engine to work on, provided that you take care to put it back together as original. One of the bugs of the early engines was the tendency of the intake valves to lose their clearance. This was due to hammering of the bronze valve seats, now replaced with stainless steel. There is an inevitable passion among race-car owners for more and more engine revs, and as soon as one owner starts over-revving, the others are likely to, too. The Spyder engine's revving ability can be easily raised by putting shims under the valve springs. The result is that today most of the front rank Spyders are being wound 1000 to 1500 rpm over the factory limit. This imparts to the engine a certain degree of fragility that the factory is in no way responsible for.

The Spyder's brakes are normal Porsche assemblies with two leading shoes and two cylinders at the front and one trailing, one leading shoe, and one cylinder at the rear. Their servo action is unusually strong, and learning to use these brakes with the right degree of delicacy is one of the tricks of learning to drive this car. The brakes are always there; there's never any doubt about them. However if you lay a heavy foot on the pedal and just hold it there you'll lock the brakes for sure, and this, Ginther feels is the most common reason that Spyders spin out. The brakes on his car had used up all the pedal travel at Palm Springs, a few days before. This was the first time, braking hard from 125 mph or so, that Ginther had observed any brake fade on a Spyder. Before we took the car out, its brakes were adjusted and when we tested them they felt like new. With three races already on them, Ginther felt sure that the linings, which have a tremendous area in relation to the car's weight, would be good for another six meets of Pomona or Paramount Ranch calibre.



Spyder is jacked at reinforced point riveted to underside of skin.

In the article on Porsche engines in last June's SCI we pointed out that for better weight distribution the 550 engine in the Spyder is mounted ahead of the transmission instead of behind it, as in all other Porsche models. The current Spyders use a normal Porsche patent four-speed box with synchromesh on all gears. A nice feature of this transmission is that the ratio of each speed can be altered without affecting any of the others. This make

it possible to adjust each ratio in the box to suit the requirements of a given circuit—very handy when you're dealing with an engine with a narrow useful rev range. Even in standard form top gear is indirect and you can equip it with any pair of gears that have a total of 49 teeth. Miles keeps detailed records on the gearing requirements of each turn on each course he drives. When he's due to drive there again, he checks his notes. If Second was too low and Third too high, he can tailor the gearbox to suit the course. This is a more flexible arrangement than just changing the ring and pinion.

For such distance events as Mexico and Le Mans, Spyders have used a 4.43 ring and pinion and 0.88 top gears giving 125 at 6700 and a race "cruising" speed of 135 to 140 mph. This amounts to an overdrive, and the normal Fourth ratio of 0.96 can then be used for Third. The normal Third of 1.23 is used for Second, and normal First is retained as a starting gear. The new space-frame Spyder has a five-speed all-synchro box and 4.85 to one final drive. Ratios are:

I: 11/35 . . . 3.18
II: 15/32 . . . 2.14
III: 19/28 . . . 1.48
IV: 23/26 . . . 1.13
V: 25/24 . . . 0.96

For some reason it seems logical to pair the Spyder with the 300 SL. Both are dual-purpose cars, that can be raced or toured. Both are engineered with boldness and imagination, and both are leaders in their sphere. Certainly what the 300 SL is to its fast and elegant class the Spyder is to 1500 competition machines. Because they cost about as much as a basic 300 SL, few Spyders have been bought for touring use alone, and cost will probably keep it that way. Their real greatness lies in their competition potential, which they've proved by sitting on top of the 1500 cc racing world for three years now.

October's Palm Springs race, however, in which Bill Drake trounced the Spyders in a 1500 cc Cooper Climax, may have been an omen of things to come. Super-light Coopers and Lotuses are beginning to infiltrate the U.S., and good drivers are getting rides in them. It's true that they're sprint machines and perhaps would break up in a long, hard race that wouldn't faze a Spyder. But in the U.S. most races are short. Porsche Spyders here are going to have to work hard to hold their own. The Porsche factory will probably work out a few answers, and it's a cinch that the von Neumann stable will find a few of its own. Miles happens to have a new Cooper-Porsche, and maybe that's one of the answers.—*G.B.*

Jaguar

(Continued from page 45)

ing and allowing it to air cool, then hammer some more. As each price is formed, fit and weld it to the framing.

Underneath all this, the suspension had received a going-over. The rear leaf springs were stiffened by adding a single leaf to each side, and have been shifted outboard of the frame. By relocating the spring pivots, the frame has been dropped over the axle some five inches. Much of this was done by inverting the rear shackles, which would angle the springs farther forward and increase the roll understeer effect.

Internally the Jag engine hasn't changed much, at least at the bottom end. All the reciprocating parts in the engine were balanced, along with the clutch and flywheel assembly, by Merrill in Denver. JE 9 to 1 pistons were fitted, at a skirt-to-wall clearance of .005 inch, and carry Grant rings. A .020 inch cut was taken from the cylinder head face, to true it up, so the final compression ratio is closer to 9.5/1. The standard Jag clutch was treated with Copsiloy, and the original gearbox was retained.

A lot more took place upstairs, though. Some forty hours were spent cleaning out and polishing the ports. After that, Jay Joyce said, making up the exhaust manifold was child's play. Two $\frac{3}{8}$ inch plates were cut and fitted to the front and rear port trios. Twenty feet of two-inch exhaust pipe and eight two-inch elbows were then bought from Sears, and the inner pipe ends made to fit the ports by expansion with a rectangular wedge. The rest of the fabricating was done by guess, and by cutting little triangular pieces to fill in the gaps. A very straight path away from the ports was the happy result.

After abortive experimentation with triple Weber and Carter setups, they decided to go all-out and bolt on a Hilborn injector. An adaptor was machined at the back end of the intake camshaft to drive the special fuel pump. Otherwise the installation was by the book, initial tuning being done on a chassis dyno. The capacity of this was soon exceeded, and the finishing touches came after timing over a closed course. The .076 metering orifice was found suitable, and eight-inch ram tubes were fitted.

The valve department is stock, except for the use of an Iskenderian XM-3 cam set. This is a 22-62 grind, with 44 degrees of overlap and a .404

(Continued on page 65)

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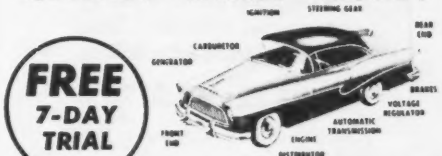

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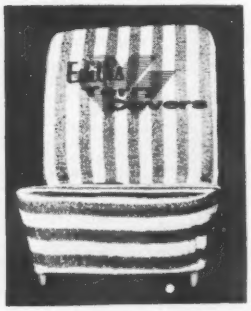

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BRM

(Continued from page 39)

ponents. The chairman, Mr. A. G. B. Owen (formerly chairman of BRM) heads some 40 companies which make up Rubery Owen & Company. One of these is the Owen Racing Organization at Bourne, Lincolnshire, which absorbed the BRM and is now building and racing the ORO, or "new" BRM.

Through all of the strife and trouble which riddled the Trust, two men emerged with clean hands and a burning desire to see an all-British G. P. contender. These two are Raymond Mays, the old-time enthusiast with a dream, and Peter Berthon, an engineer with patience and the desire to make machines GO! Careful to avoid the complications which arose with the old car, they gathered the personnel of the Owen Organization around them, and retired to the confines of guarded experimental shops to design and develop a completely new machine.

After months of secret experimentation, the car was presented to the Press and then placed into the road development stage at Oulton Park and Silvertone during the winter season, where the cars could be tested without public observation; it was during one of these winter runs that I was privileged to observe and photograph the new BRM as a guest of driver, Stirling Moss. He, Peter Collins, and Ron Flockhart were asked to run the car at speed to test the handling and suspension characteristics.

The new machine is, without a doubt, one of the finest looking G. P. cars ever built. Surprisingly small and compact, it has a profile like no other car, embodying exciting lines which are more European than British. The finish is perfect to the smallest detail, and whether on the track or at rest it looks light, strong, extremely low and very fast.

A 2½ litre (2,490 cc) unsupercharged four-banger powers the little wagon, and is in direct contrast to the complicated V-16 of the previous machine. Peter Berthon, remembering how difficult it had been to develop the V-16 without extensive facilities, came up with a straight-forward engine, designed for simplicity and low cost.

This conventional layout has twin overhead camshafts, driven by a train of gears from the rear of the four-bearing crankshaft. The shafts operate two valves per cylinder in a hemispherical head, each valve having two hairpin-type springs facing fore and aft. Each cylinder has two plugs (an experiment was made using three plugs), and at present two double choke Weber type 58DCOA3 racing carburetors are fed directly by air ducted from the central section of the nose intake. This intake is divided into three sections, the two on either side cooling the water, while the lower part of the center section is directed onto the twin Lucas Magnetos mounted in front of the cylinder block.

Oil and water pumps are driven from the front, water being the heat-exchanging medium for cooling the oil. The car uses a spectacularly tuned exhaust system, in which four separate pipes eventually blend into an enormous tailpipe. The engine is mounted rigidly into the chassis, transmitting considerable vibration throughout the car.

After two trials at Oulton Park, a 2.76 mile road-type circuit, Stirling Moss described the car as "fantastically fast", and proceeded to break his own lap record (set with his G. P. Maserati) by turning a lap at 1 minute and 52.3 seconds. When he had tried the car, it was suffering from lack of weight on the front wheels, making it "snake" badly when accelerating out of turns. He remarked at the time that the BRM would be a world beater if this weight distribution fault were corrected, and that even the 1955 G. P. Mercedes performance could be eclipsed when the BRM is "ready".

During its first shakedown season, the BRM was piloted by Mike Hawthorn, Tony Brooks, and Ron Flockhart. It was purely a season of test, during which the car suffered from minor, frustrating faults, but showed a fantastic potential—a potential which at times frightened the European competition with displays of blazing speed.

At Monaco the cars were withdrawn the day before the race because of stretched valves. Valve trouble dogged the car and sidelined the machines for two months. At Goodwood, Hawthorn crashed with a seized halfshaft inner universal joint. During the running of the Aintree International "200", Hawthorn qualified for the front row, and was off the grid and into the first turn far ahead of the pack.

Berthon's design group have spun themselves into a vicious circle over these valves. To begin with they have a bore and stroke of 4.05 by 2.96 inches, giving a piston area the equal of the GP Maserati, which itself is good for a six. This huge bore allows intake valves around 2¼ inches in diameter. If made solid these would be very heavy and hard for the springs to control (for this reason Tressillian's first layouts provided 16 valves), so the stems and heads were made hollow and sealed at the head by a welded-in washer.

At high revs the weight of that big head has fractured some of these welds, and this has been mildly described as "stretching". Since they're at the end of their string on valve spring pressures, the designers have had to accept a lower valve bounce speed as a result of a heavier solid valve design. This is a stopgap, but prevents the use of the high revs that were foreseen when the short-stroke engine was planned. Again, modern fabricating methods seem to be falling behind the BRM concept.

Later, while leading, the brake fluid boiled, sending Mike bouncing across the fields brakeless. With three-quarters of the race gone, Brooks led the field by 25 seconds, and shortly set the lap record for the day. He also encountered brake failure, but continued on the gears to take second place. At the British Grand Prix at Silverstone, Hawthorn qualified for the first row, with Brooks slightly behind; both out-accelerated all their rivals.

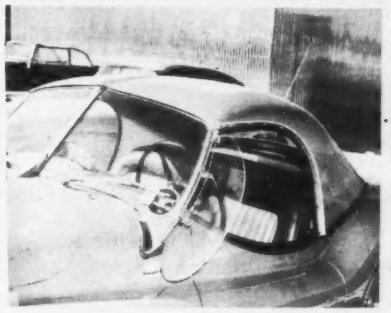
Loss of grease in the transmission brought Mike into the pits, while Brooks carried the BRM colors. A nasty moment when the throttle stuck open, however, caused Brooks to go end over end, with the car bursting into flames. Tony was thrown out of the flying car without serious injury, but the BRM was destroyed by the fire.

Ron Flockhart had withdrawn early, with engine failure. During the VIIIth International "Daily Express" Trophy Meeting, Hawthorn led the first 13 laps with little opposition, establishing a new lap record of one minute and 44 seconds (Silverstone), or 101.32 mph. However, during the fateful 13th lap Mike's machine stripped its timing drive, leaving him stranded. The team retired from the remaining events to retrench and plan for '57. Extensive tests at Monza have already been carried out.

Although some bitter criticism has been raised about the performance of the new BRM racing machine and its fitful baptism, most British experts agree that the breakdowns encountered were to be expected of a new car, and that basically the car shows promise of a great 1957 season. The Owen Racing Organization is, so far as possible, a practical business; if this were not so, the parent company would have wrapped it up for disposal long ago.

At a time when German and Italian industry is challenging British industry as a whole, using their overwhelming dominance of the auto racing business as a major springboard to sell quality and endurance through competition wins, a successful British Grand Prix machine is sorely needed. Several are very close; the BRM looks good enough to win.

Bob Rolofson



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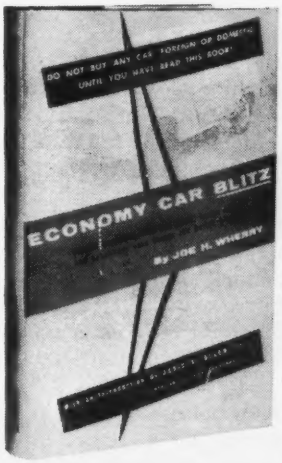

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PIT STOP

See page 10

Austin-Healey

(Continued from page 43)

have been developed. Its inserted ribs aren't too sightly, but they absolutely prohibit flapping in the breeze.

The 100-6 is a worthwhile step forward in power and passenger space, but some mild sacrifices have had to be made. Wheelbase has been stretched two inches, and the battery has been moved to the shrinking trunk to make up for the forward weight shift of the engine. The spare tire has also been relocated to the rear.

Basic handling character is the same as the '56, with a moderate degree of understeer and an easily-induced but fully-controllable rear end breakaway. Speed of the steering is adequate, and it has just the right amount of road feel. and reaction with a mild caster action. Increased weight has caused it to feel heavier at low and parking speeds, while there's a shade of play in the straight-ahead position. On the open road the Healey is stable and gust-resistant right up to the easily-reached 100 mph mark.

The 100-6 rear axle is solid and heavy, and you know it's there on a tight, bumpy corner. Proper adjustment of tire pressures can reduce rear-end skittering, though tire noise is simultaneously increased. We found 23 pounds in front and 25 in the rear to be a good combination, after trying everything from 18 to 30. For competition work on smoother roads, 30 and up would of course be needed. This Healey had the optional new Dunlop Roadspeeds, with rounded and siped treads. Knowing the wet-weather reputation of the older Roadspeeds, we threw the car around on everything from damp concrete to drenched bricks. On the latter we could apply full bore at 20 mph in first gear without breaking loose, and there was absolutely no loss of controllability in all kinds of corners. The new Dunlops are excellent.

Riding qualities of the Healey are good, and the already satisfactory resistance to pitching has been increased by the new length and mass distribution. You feel most of the small bumps and ripples, though. They're damped out somewhat by the seats, which are well-cushioned underneath and firm in the back. Support for the small of the back is moderate, while the shoulders tend to be above the bucketed area. The seat backs pivot forward for access to the rear compartment, and are flexible as a result.

External door handles are a new convenience, and the doors are two inches wider to improve the entry condition. Getting in and out is still awkward with the top up, though. Leg room is fine with a wide range of seat adjustment. Elbow and arm action space is also very good, even with the side curtains in, and the adjustable steering wheel is a big help. The same can't be said for the headroom, which without seat belts or crash helmet is adequate only for those five feet, ten inches tall or less. To top it off (literally) there's a top bow right above the driver's head. The nice flat roofline is very attractive, to be sure, but the car is uninhabitable for a six-footer.

The pedals are good-sized and easy to hit, though the accelerator pad and the brake are so far apart that heel-and-toeing is for contortionists only. Small switches on the dash are handy and positive in action except for the windshield washer, which looks and is an afterthought. Instrumentation marking has been switched to black numerals on silver, and is still readable both by day and night. Stray light under the dash can be scooped up for map reading. On the passenger's side of the driveshaft hump, the handbrake is out of the way when released and easy to apply. Since side curtains are still used, there's a lot of storage space in the doors, plus the package shelf under the dash and the new "back seat". The trunk isn't what it once was, but it can still hold a suitcase and a half. The battery and spare are sturdily battened down, and there's a compartment at the back for the very extensive tool kit. At last the fuel filler has been moved out of the trunk, to a spot high on the rear deck.

Brakes are unchanged for '57, following an enlargement in last year's cars. They're fine for fast touring, once you get used to the high pedal pressure required, and they returned some very good deceleration figures. These tapered off at the end of ten stops but came back quickly. They were always smooth and well-balanced.

Following earlier Austin policy with this model, the 100-6 will be retailed in this country fully equipped, the price of $3095 at port of entry including such normal extras as overdrive, heater and defroster, wire wheels and tonneau cover. This is up $110 from last year, which is very reasonable for the widespread improvements offered. It's no secret, though, that a non-overdrive, disc-wheeled version is contemplated for English consumption at least. This would have a different rear end ratio and a significantly lower first cost, but there are no plans to bring it over here in the near future. The familiar De Luxe version is just that: a thoughtfully-outfitted 2½ seater with a smoothly unobtrusive way of outrunning most other cars in its class. Refinement is the key word for '57, in both mechanics and accommodations.

—Karl Ludvigsen

(Continued from page 61)

inch lift. It's strictly for medium and high rpm work, and was also used in the Pikes-Peak-winning Jag-engined special. More go low down is given by the Isky XM-2, which has the same lift but a 17-57 timing, giving 34 degrees of overlap. Mildest is the X-5, which shares the XM-2 timing but has a lift of .390 inch.

Ignition is by Mallory MagSpark, with a static advance of eight degrees, and Lodge R47 plugs do the dirty work. All these changes have pushed the horsepower close to the 260 mark, at 6000 rpm. The resulting bear, with Jack at the wheel, has been a consistent class winner in its maiden races and has been beaten overall by Ferrari Monzas only. Just to prove its versatility it was top eliminator at the Albuquerque drags.

Out of the pocket this competition threat cost less than a new TR-3 Triumph, but add in over a thousand hours donated by Jack and Jay. There's no doubt about those hours being well-spent, since they've shown again how suitable the Jag is for the regular hop-up route.

The same conclusion has been reached by no less an organization than Momo's, in Woodside, New York. Alfred wanted a little more low-speed punch for at least one of his team of Cunningham-Jaguars, which were proving embarrassingly sluggish on short courses. He elected to bore one Production D-Type engine out .170 inch, and fit domed, full-skirted JE pistons. This set was rated at 10 to 1, but checked out at nearer 9.8 to 1. For this application the Isky XM-2 cam set was chosen, to keep a wide range of useful revs, and they have a brace of XM-3's handy just in case. The 45 mm. Weber carbs are fitted with 36 mm. venturis, which keep gas velocity and compensation high while choking top-end power slightly.

Nowadays when Johnny Fitch or Walt Hansgen tromps on it, this D can walk away from its close relatives, plus most of the opposition. They have recently clamped the big-valved 35-40 "works" head on this expanded block, which may be even more what it needs. While hoping and waiting for the Lucas rig from England, the Cunningham crew is also trying out Hilborn injection.

In other words, whether you build your D-Type or buy it, the Jag twin-cam six is just yearning for you to squeeze out that extra little bit. If you like inches there are 210 of them in the big engine, while the short-stroke 2.4 is meat for the rev-mongers. They're new blood for all types of U.S. racing from Bonneville to Sebring.

— *Eric Nielssen*

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Formula II

(Continued from page 49)

and has a Chrysler-like valve gear arrangement. It's held back now by a primitive induction system, and could be loosened up considerably. The French Constantin sports car used similar engines at Le Mans, usually with a blower.

One way or another, the renowned name of Porsche has been among the top in Class F since the war, and has greatly boosted German prestige. Their original VW-based pushrod engine was developed to a reliable 85 horses for certain Le Mans and Mexico cars, and could probably be super-tuned to 100 bhp for shorter-distance events. SCI has discussed both this plant and the fabulous four-cam 1500 RS engine in the past (June, 1956), and the latter should be a very hot base for an F.II car. Perhaps it's fortunate for special builders that the Porsche factory feels now that sports car racing is more important to them commercially than the new Formula. We'll just have to find a wrecked Spyder somewhere.

The Porsches have often led, but occasional rapid Borgwards have never been far behind. Production engines from Bremen have a nice overhead valve arrangement and downdraft intake ports, and even in touring TS form they deliver 75 bhp. They've had a lot of experience with Bosch injection, and their bristling 16-valve racing engine (SCI, November, 1956) uses this and a lot of other know-how. It could be dynamite now, and hasn't reached the end of its development string.

Another high-altitude threat is the East German AWE. It carries a very workmanlike twin-cam mill which equals the top-end output of the hottest 1½ liter sports cars, and does it with complete reliability. It is perennially rumored to appear with desmodromic valves and fuel injection, which would be the final touch.

There's also a pair of rocker-box fours from Germany, the Ford Taunus and the Opel, which are encountered now and then in this country. Neither is sensational, but they are both well over-square and would be responsive to MG type modification.

Often referred to as a cross between Volkswagen and Porsche, the Austrian WD or Denzel automobile has become respected in the post-war rally world and is now available as a 1500 cc competition machine. Denzel parts can do a lot for the VW engine, and might make it a respectable racing unit.

Still in the squarehead section is the Volvo PV444 powerplant, which is strongly reminiscent of the XPEG MG. The 70 horse sports version has been doing wonders in its sedan, and with the five-speed gearbox, now available in limited numbers, it would be a usable package.

There's no scarcity of good racing engines from Italy, but the range of production plants can be indicated in one word: Fiat. And the closest *it* comes is the 1400 model. In spite of a miserly 1395 cc displacement, this has a piston area the equal of any stock 1500 engine. Boring and stroking would bring it into range with the rest, and there's a lot of Siata and Nardi hop-up equipment available for it.

Perhaps by this time the year-old 1½ liter Alfa Giulietta prototype will have reached the production line, and if so it should be a fine basis for a home-built Formula II car. It would be by far the cheapest twin-cam engine for the job, and it might even be worth working over a 1300.

With the classic Maserati bore and stroke dimensions, the 1500 cc Osca sports car has been a giant-killer since it was introduced. Its engine is now dead-reliable and broad-ranged, and is a cinch for F.II. Here too, desmodromic valves have been planned for some time.

Jean Behra put the 150 S Maserati in the limelight at the Nürburgring, but since then the brilliance seems to have dimmed slightly. The trouble appears to be with the car and not with the engine, though, and power is plentiful at the top end. If raced by the factory, this will be among the ones to beat.

As usual Enzo Ferrari has taken concrete steps to exploit this formula, and his new V-6 with staggered bores and a three-bearing crank has already been run on Modena Airdrome. The current claim for this engine is 170 horses at 6000 rpm, which puts it in a class by itself. This is a better specific output than he's ever reached with fuel in the Lancia-Ferrari GP cars, so it may be taken with some reservation. He's also planning a four-barrel, and huddling in the shadows there's the formidable Colombo V-12 that formed a nucleus for post-war Ferrari racing cars.

Right in our own back yard, Meyer and Drake are well along on development of the 91-inch Offy (SCI, October, 1956), and plans are under way to build a team of cars around it. The latest version, with revisions in the top end and the crankshaft thrust surfaces, has been on the dyno for some time now running with strictly 100 octane. All combinations are being tried, with the emphasis on top-end power, and it should be the best international competitor from this country in a long, long time. Place your orders now, gentlemen!

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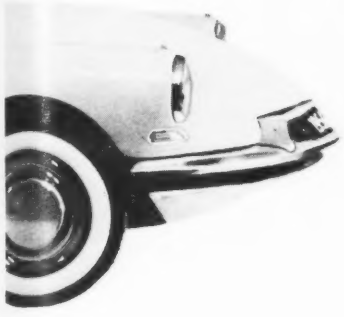

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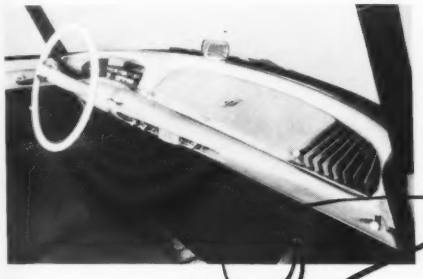

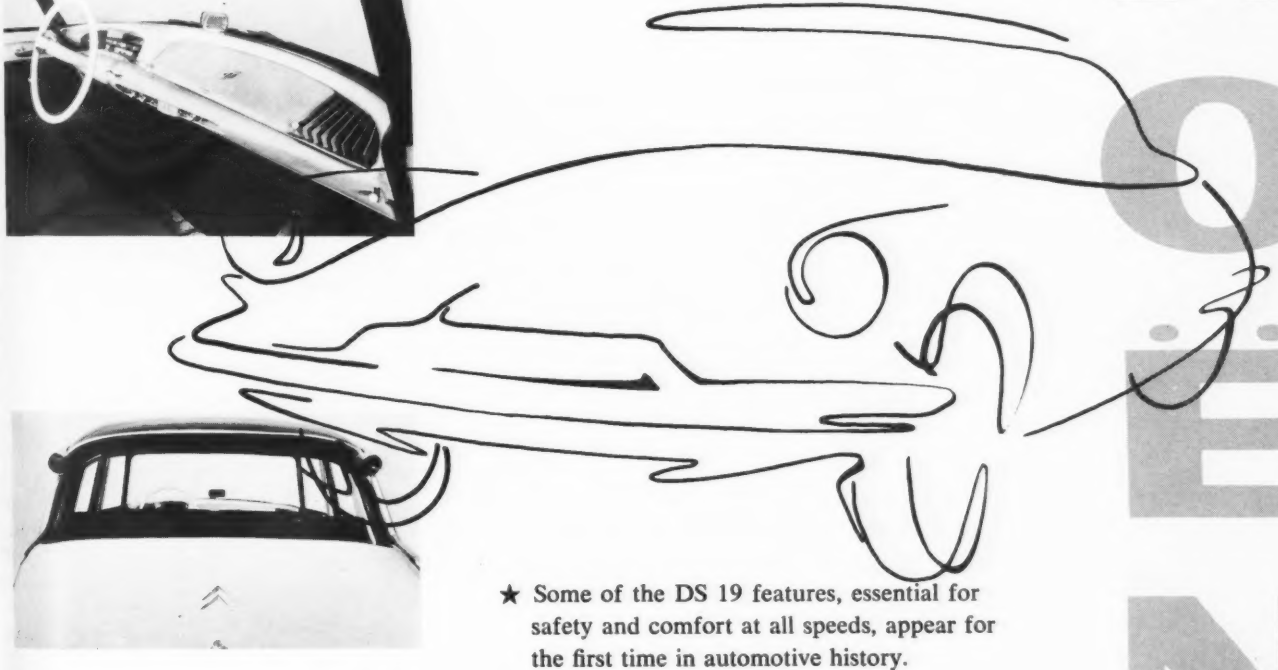

★ Some of the DS 19 features, essential for safety and comfort at all speeds, appear for the first time in automotive history.

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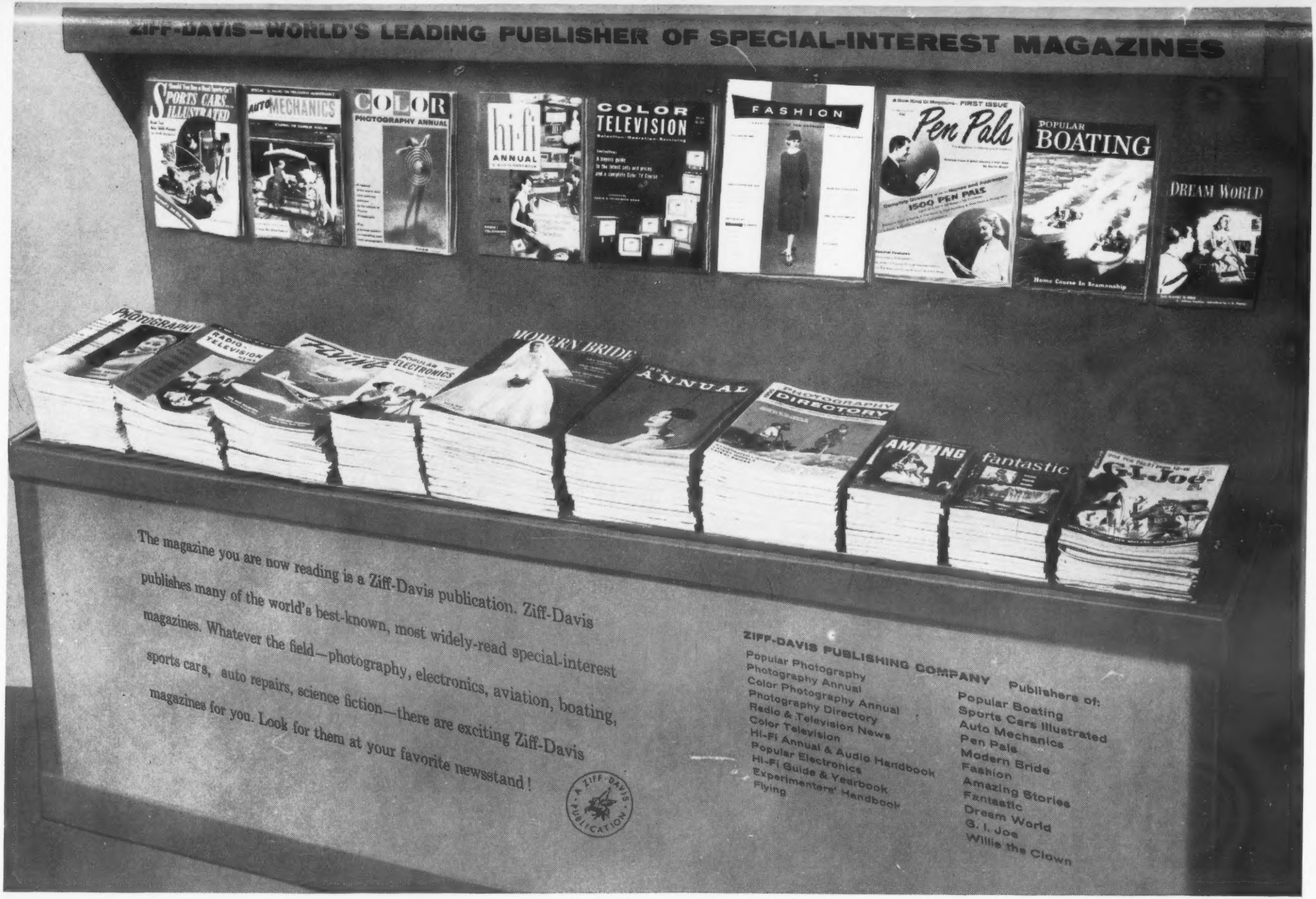
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